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Property 1830

A PRACTICAL TREATISE ON DYING OF WOOLLEN, COTTON, AND SKEIN SILK, THE MANUFACTURING OF Broadcloth and Cassimere,

INCLUDING THE MOST IMPROVED METHODS PURSUED IN THE WEST OF ENGLAND, IN WHICH THE VARIOUS MANIPULATIONS ARE ACCURATELY DELINEATED.

ALSO,

A correct description of

SULPHURING WOOLLENS,

AND

CHEMICAL BLEACHING OF COTTONS.

BY WILLIAM PARTRIDGE.

NEW-YORK:

PUBLISHED BY H. WALLIS & CO. FOR THE AUTHOR.

J. W. Bell, Printer, 70 Bowery.

1823.

REVIEW BY
DOCT. S. L. MITCHILL.

"I was much gratified by the detailed and practical explaination you give of the woollen manufacture. The pertinency and judgment of your remarks on the domestic articles of sumach, quercitron, maple, and pydolaria, are worthy of the most attentive consideration. So are your remarks on the culture of woad, madder, and the olive.

"The subjects on which you have written are of very great moment and extent. They are becoming daily more so. Whether your valuable book will sensibly accelerate the objects it contemplates, time will show. I think it will; as it ought to have that effect; and assist in rendering our country less dependent than heretofore, and now, on foreign labour, for the coloured goods on which you treat."

SAMUEL L. MITCHILL.

New-York, Dec. 20, 1823.

REVIEW BY
DOCT. FELIX PASCALIS.

"In a country like this, where capitalists, and other industrious classes, call loudly in every journal of the day, in every electoral meeting, and sovereign legislature, for the encouragement of domestic manufactures, this work is an acceptable and welcome present.

"Good materials for manufacturing woollen are daily furnished; and fine specimens of that species of fabric are often proudly exhibited; but, whoever feels inclined radically to promote public wealth and industry, may become well enabled to judge of what improvements and practical knowledge are still wanting, by a perusal of the 'Treatise' of of Mr. Partridge.

"As a writer, that gentleman is clear and perspicuous, an acurate observer, and a lucid expositor, in every department and branch of his business; and whether he treats of the competency of manager or workman, the reader perceives that he speaks from the authority of an experience, drawn from paternal initiation, and long familiarity with his profession in England as well as in our States. He has rendered his work doubly useful and interesting by uniting the subject of the manufacture of broad cloths and cassimeres to the complete exposition of the art of Dying.

"It is not my purpose at present to enter into a review of the work of this eminent artist; it forms a closely printed volume of 288 duodecimo pages. Such an entertaining analysis as it would, however, prove, will, it is hoped, be accomplished by some more competent judge. I will only remark that more than ordinary praise is due Mr. Partridge; and that he is particularly entitled to the patronage of the community to which he belongs as an adopted citizen; for he has cheerfully imparted without reserve or national prejudice, the means of improvement and extended advantage, in a branch of usefulness, with which but few individuals in this country are as yet thoroughly acquainted. His work is also as worthy of the attention of the learned as of the artist. It is an aid of decided importance to national industry, and a valuable tribute to the Republic."

FELIX PASCALIS.

New-York, Dec. 26, 1823.

THE AUTHOR

To his fellow-citizens of the United States of America.

ALTHOUGH by birth and education I am an Englishman, yet I was taught from my earliest infancy to consider civil and religious liberty as the first of earthly blessings. As these inestimable privileges are more generally diffused and better secured in this than in any other country, it has therefore been the country of my adoption. To assist in perpetuating your system, is my most ardent desire, and I know of no better means than by promoting internal industry, being convinced that an idle and necessitous population is the main pillar of tyranny!! That your population is already too numerous for the means of employment will not be disputed—can it then be good policy to pay twenty million of dollars annually for foreign labour, and permit your own citizens to remain idle for want of employment? This is a political absurdity we could not give credence to, were not its existence proved by daily experience!! If this work should contribute in the smallest degree towards establishing one branch of manufacture, that will find employment for three or four hundred thousand of your population, it will not be considered as useless, and the author will be amply repaid in the satisfaction of having done his duty as an adopted citizen.

ERRATA.

Page 49, line 16, for require, *read* acquire.
—— 64, line 20, longest pullies, *read* largest.
—— 84, line 18, for treated in, *read* heated in.
—— 97, line 16, for observations, *read* aberrations.
—— 106, line 28, for band, *read* barrel.
—— 116, line 16, for valuableness, *read* variableness.
—— 121, line 13, for opinion given, *read* opinion now given—14, for greater importance, *read* great importance.
—— 126, line 28, for portion of cloth, *read* portion of both.
—— 131, line 23, for moued, *read* mosed.
—— 132, line 7, for score, *read* scoured.
—— 193, line 1, leave out first sentence beginning with "was the wool, &c."
—— 197, line 31, for dying, *read* drying.
—— 216, line 26, for scour, *read* sour.
—— 217, line 27, for and divide it, *read* and divided.
—— 226, line 5, for to black, *read* to bleach.
—— 276, line 32, for there are not, *read* they are not.

INDEX.

A

INTRODUCTION.

THE support of the woollen manufacture has been a primary object with several European governments, more particularly so with England, where such duties have been laid on foreign articles of this description as have amounted to a total prohibition; but whatever value may be attached to it in other countries, it is doubly valuable in this. The greater portion of the population of Europe, are too poor to wear expensive clothing, the cloth they purchase, being of very inferior quality, and one suit will last them four or five years. In this country the poorest citizen will have an annual suit, and mechanics two, and the cloth they wear is of a quality equal to what is worn by the substantial farmers and tradesmen of England. I cannot much err, therefore, when I assert, that in the article of woollen clothing, the inhabitants of the United States consume in quantity and value, doubly as much as any other country of the same population.

The wool sheared in Great Britain is about one hundred and forty millions of pounds annually, and the quantity imported, about one hundred and sixty millions, making a grand total of three hundred millions of pounds per annum. The average value of the wool raised at home, is about one shilling and twopence a pound, and the imported, three shillings and sixpence, taking the latter at what merchants give for it in foreign countries. Each pound of English wool when manufactured, will be worth four shillings, and the imported eleven shillings, which will be three times the original value, making due allowance for the oil and other imported articles used in the fabrication. It will be perceived from this concise statement, that England, for every pound of wool sold in a manufactured state, is benefited in twice the amount of the cost of the raw material. She is enabled, also, by the aid of capital and machinery, to turn out as much work, with a population of five hundred thousand, being nearly the number now employed in this description of manufacture, as could have been done sixty years since by five millions; nor do their profits end here—agents are employed to sell in foreign countries, where many of them make large fortunes, and return home to the mother hive loaded with the fruit of their enterprise and industry. These agents exchange manufactured articles for raw material, and sell to a much larger amount, which increasing the rate of exchange,

other capitalists, as well as those employed in commere, are enabled to make considerable profits.

It is in this way that England is enriched by her commerce; this is the talisman of her envied superiority! and she has always esteemed her woollen manufacture as a principal source of her wealth. There is, therefore, no manufacture the establishing of which is of so much consequence to a nation as the woollen in all its branches—the articles made in it are more numerous and more costly than in any other, and among these, that of broadcloth and cassimere, stand conspicuous for their value and general consumption. Let it be distinctly understood, that every American who purchase one hundred dollars worth of European woollens, is contributing towards the support of other countries, in the sum of sixty-six dollars, and impoverishing his own in exactly the same amount!!

If we reason from what has taken place in other countries, we must acknowledge that the woollen manufacture is the most difficult of any to establish, and the most tardy in being brought to perfection, particularly in the finer qualities. That of cotton has been in existence only a few years, whilst centuries have been occupied in bringing woollen to its present state. Our manufacturers, therefore, should not be impatient because their progress has been slow.

I have no wish to magnify beyond measure, the difficulties our manufacturers have to encounter, yet it is of primary consequence that these should not be underrated. In objects of less magnitude, which can be executed by the ingenuity and industry of individuals, little impediments to their progress are easily seen and as easily removed; but in an extensive and complicated manufacture, where the operations are numerous, and where each one must be well performed, in order to compete successfully with other nations, it is absolutely necessary that every impediment should be viewed in its full extent, and the utmost exertion employed to remove it.

It requires two pounds six ounces of fleece wool of three-quarters, and full blooded merino, that has been well washed on the sheep's back, to make one yard of stout superfine broadcloth. The expense in making, for workmanship, superintendence, interest on machinery and plant, and repairs, is more than owners of factories are generally aware of. There cannot, in the present state of manufacturing, be much saving made by lowering of workmen's wages. I should presume not more than fifteen or twenty cents on each yard; but the value of the goods may be so much improved by perfect workmanship, as to make the cloth fabricated from these qualities worth one dollar more on each yard in the present depreciated state of the market, than they, now generally are, without adding to the expense of making.

We will take it for granted, that woollen factories, that have been well managed, with credit and capital to purchase to the best advantage, were last year making twenty per cent. on their returns, which profit, so far as I have the means of calculating, comes pretty near the truth. Let us see how they will stand when imported cloth is as low as we have reason to expect. Woollen goods have fallen, in England, within a year past, about eight per cent., and exchange here, has fallen four, which makes the cloth market twelve per cent. more against the American manufacturer, than it was eighteen months since. I have recently received accounts from an English manufacturing district, that fine wool has fallen there, more than fifteen per cent., which, with the bounty allowed upon exports, will enable them to invoice the spring shipments at ten per cent. below the late invoices If added to this, the exchange that is now eight per cent., should come down to par, our best conducted manufactories must become losing concerns. I hope no such crisis may take place, but as the event is by no means improbable, the manufacturers should endeavour to meet it, by making their goods so perfect, and by putting their establishments on such an economical footing, as may then enable them to support a competition.

There are three leading defects in most of the cloths made in this country. The wool is not well scribbled, the warps are too crowded, and the nap is not more than half raised. Scribbling is too often neglected in England, as well as in this country; it ought to be scribbled twice; this is done by a few of the best English manufacturers, and it wonderfully improves the fabric, it spins better, is softer, more free from nips, and indeed works better in every succeeding operation. The scribblers in the west of England are, however, only single machines, and here they are generally double—the wool ought, therefore, to be as well scribbled here at one operation, as it is there at two, provided the machines are as well made, and worked with equal ability.

Wool of middling quality is, in England, spun into skeins of eighteen to twenty the pound, for the abb, and from twenty-four to twenty-five for the warp, for stout broadcloth. The skein being three hundred and twenty yards. This quality is generally set on the loom eleven and a half quarters, and seventeen hundred, or eighty-five bier—each bier containing thirty-eight threads. For fine quality wool, many of the best manufacturers spin the abb no finer than for the middling quality, though the warp is spun five skeins finer, and the chain is warped eighteen hundred, and set on the loom twelve quarters. The fine quality may be set the same width on the loom as the middling, but the bier must be lowered. The strength of the fabric lies in the warp, but when this is too much crowded, the weaver cannot drive in sufficient filling to af-

ford a thick nap, as this is almost altogether derived from the filling.

When cloth is correctly and faithfully made in the loom, the workmanship will be thrown away, unless the nap is properly raised. In this branch of the manufacture, the American fabrics are in general miserably deficient. I lately called to examine the prize cloths that were purchased at the late fairs, fully expecting to find it tolerably perfect in this respect, but I am sorry to have to say, they did not meet my expectation. The nap was thin and straggling, and the threads plainly to be seen, without even a close inspection. The cloths were otherwise well made. This defect belongs to almost every cloth I have seen, that has been made in this country. Instead of giving it a large portion of dead and middling work, the nap is cleared out too soon with quick teazle, which makes it easy to the workmen, but proves ruinous to the manufacturer. Such goods when cut low enough to make a short nap, will leave the cloth thread-bare, and when left too long, the face will be covered with a rough, uncouth nap. Cloth will stand a large portion of dead and middling work, without injuring the fabric, and the more it has in moderation, the finer and softer the face will be; but it is very liable to be damaged when new teazles are employed; and when these are used, which should always be towards the end of the operation, care must be taken not to give more than the fabric will bear.

Those who are conversant with the imported cloth market, must have seen that fine cloths made from the same quality wool, will command very different prices, that there will be from one to two dollars per yard difference in the value. This increased value is the result of perfect workmanship; and those manufacturers who have succeeded in making the most perfect article, have accumulated large fortunes, whilst others who have made them inferior, have not much increased their capitals. This is by no means surprising, when we note that the difference in the value of the goods pays for the whole expense of making. A similar difference is observable between the cloth fabricated in this country; and surely this important fact ought to convince every manufacturer of the necessity of making perfect goods.

The fulling and dressing of cloth requires great attention. In milling of blues, it is a good method first to scour them out, before fulling, with a little thin soap and water, new laying them in the stocks and scouring this with water clean away, going with them about an hour, this will rid them of a great deal of filth and lime, and the felting will afterwards go on better.

I have given instructions for raising the nap after the manner generally practised by the west of England manufacturers twenty years ago. Since this work has been in press, I have received in-

formation from a respectable maker, from the same quarter, giving an account of the process now pursued by their most celebrated manufacturers. This process will occupy more time, and consume more teazle than the former. In raising, they give from twenty to twenty-five mill-full of work, beginning with the deadest and proceeding to the quickest. The cloth should be rather dry at the beginning, and kept so nearly to the quick work. If too dry, the flock will be seen to fly off like dust, then it must be slightly moistened; but with the quick work it must be kept quite wet, and the wool should be changed once or twice every mill-full.

An opinion that cloth can be better raised by hand than by the gig-mill, is prevalent among the woollen manufactures of this country, which is truly an unfortunate impression, and one that is highly injurious to the manufacturing interest. I will venture to assert, without fear of contradiction, that there is no celebrated maker of fine broadcloth in any part of England, whose raising is not performed by the gig-mill.

Manufacturers who put as much stock in their cloth, as I have directed, may hear an occasional complaint of their being too stout; this objection arises from defective raising; for were the cloth done justice to at the gig-mill, they would never be complained of; but when the wool lies in the ground instead of being placed on the surface by raising, and there cut down very low, the cloth instead of handling mellow, will feel hard and stiff. To this cause must be attributed the objection generally made to American cloth when fabricated with a full body. The French and Germans, particularly the latter, put more stock in their cloth than the English, the substance being reduced by raising to any standard their market may want.

I have mentioned under the head oil, after having described the properties of such as can be used on wool, that nearly all the fish oils were unfit for the purpose. I have since received such information from a respectable dealer in oil, as to induce me to believe that the best sperm will answer for oiling of the finest quality wool. This dealer informs me that no oil will combine more readily with the volatile alkali, that it is the least drying of any known oil, and that it has been brought into disrepute among woollen manufacturers, by having been adulterated—it being commonly mixed by disreputable traders, with other fish oils that is cheaper and less pure. This gentleman has served many of the first factories with fine sperm that has been found to answer perfectly well. If this be correct, which from the intelligence and respectability of my informant, I have no reason to doubt, the woollen factories may be supplied with a good article at little more than half the price of galipoli, provided they purchase of such dealers as will give them a genuine and prime article.

I believe this is the only work in the English language on the manufacturing of broadcloth and cassimere, none other having ever come under my notice. I have endeavoured to give every instruction that is necessary to the well performance of the business in the plainest language, and sufficiently clear and ample for the most ignorant to follow. That nothing might be wanting to make the work complete, I have obtained the latest and most approved modes of making those fabrics from the west of England, and have added a table of all that is requisite to guide the manufacturer. Some of the information has been received since this introduction was began, and I considered it would be useful to give it in this part of the work. There will be various opinions given by European workmen on the mode of making these goods, some will be recommending one system, and some another, which serves to show there is considerable latitude in the practice pursued in other countries, as well as in this. The system I have given is such as is followed by the best Gloucestershire manufacturers, and if inquiry be made among the importers of fine woollens, it will be found that the cloths imported from that county, are fully equal to those brought from any other part of England, this system must, consequently, be as good as any practised in that country, and well worthy the attention of American manufacturers.

There are several works extant on the art of dying, but none deserving of notice that is sufficiently practical. Bancroft and Cooper were not practical dyers, therefore, it could not be expected they should give the minutia of the art, which defect renders their works almost useless to the greater number of dyers. To be merely informed of the materials necessary to produce a given colour, can never make a dyer, it is equally necessary that every part of the workmanship should be given, and herein all works hitherto published on the art have been deficient. The time of boiling the dye wares, of running the cloth in the furnace, and of boiling it therein: the preparing of different solutions preparatory to dying, and many other particulars that may appear trifling to persons unacquainted with the practice, is as essential to the production of colour as is the receipts for dying. Those who have read the above-named authors, must have observed that they prescribe a given quantity of mordant in proportion to the weight of the goods dyed, without any reference to the colour, or to the state of the goods. There are but two colours that will admit of the portion prescribed by them being used, which are red and yellow—were one-fourth or one-fifth of alum used in general, it would ruin the colours, and if that portion were used on wool, it could never be wrought into cloth. Alum and other mordants produce a specific effect on every colouring matter employed in dying, and the quantity used must be in proportion to the hue of

the colour intended to be obtained, consequently, no general rule can be laid down.

Doctor Cooper's treatise is altogether a compilation selected from almost every author that has ever written on the art, but principally from Hellot and other old French writers, whose works have been published many years, and whose formula have been long exploded. That the Doctor was never practically engaged in woollen-dying, may be inferred from the fact that in every instance where he has given his own opinion, it is uniformly erroneous.

Doctor Bancroft's work is intrinsically valuable to the scientific artist, and has been the means of introducing great improvements in the practice of dying and calico printing, but as all his experiments were made on a very minute scale, it is of no value as a dyer's text book.

The receipts I have given for dying are such as are used in the west of England, and are, what we term, the best mode of dying. It will be understood, that we have in Europe, two sort of dyes, one of common colours, that are employed on low priced goods, and another of a superior kind, that are used on goods of a better quality. Those I have given are of the best kind, all taken from actual receipts now in my possession, with the original patterns attached to them. It will be observed that some of the materials used there, are not much known in this country, such are weld, barwood, and green ebony. The best substitute for weld, so far as it regards colour, is the quercitron, or black oak bark, which affords a colour equally as good as the other, but, being a powerful astringent, it does not leave the wool so soft as the weld. Barwood is undoubtedly the best dye among all the red woods for browns, and many other colours requiring a red body. Camwood is generally employed as a substitute in this country. Green ebony gives a strong greenish yellow, and no other dye-stuff will produce exactly the same shade of colour. The red wood sold here is very different from that which bears the same name in England.

There is, in this country, a deficiency in many dying materials which renders it difficult for our dyers to equal the English. The mordant, called argol, is but little known here. There is a great range in the quality of this article, and as great a difference in the price; sometimes the most inferior quality will answer a better purpose than the best, while in other colours the finest is required. It is seldom that more than one quality of madder is seen here, and this has to be used for every description of colour. In my receipts it will be perceived that mull madder is sometimes prescribed, and at other times, ombre, gamene, and crop. How it has happened that only one quality has found its way to this country, I am at a loss to divine; but, however it may have occurred, the want of the

various qualities, is a serious injury to our dying establishments. When fine ombre is prescribed, in any receipt, the madder usually sold here will answer, it being of that quality; but when mull is prescribed, it will be necessary to use a much smaller quantity than is mentioned in the receipt, and even then, it will not produce the same colour. When fine crop is directed to be used, which is always the case in fine madder reds, the dyer will not be able to find a substitute excepting in the expensive article of cochineal.

There is another serious impediment which must operate against American dyers that I was not aware of till I began the dye-drug business. In looking round the city of New-York with a view to purchase dye-woods, I found much that was offered for sale was miserable stuff, totally unfit for the use of the dyer. Some lots of fustic, nicaragua, and camwood, were worth little more than for fire-wood, aud should these find their way to our dying establishments, it must prove ruinous to the consumer. The logwood is generally of a good quality.

To colour a permanent blue is the most difficult process in dying. All other colours may be done by a receipt, and when once well performed, may be repeated with the utmost certainty, provided the water and dying wares are the same; but it is not so with woad dying, in this a constant judgment is required. It depends altogether on a given stage of fermentation being equally and constantly preserved, and as this is ever liable to vary from a variety of causes, the operation is thereby rendered very difficult.

It was recently announced in the papers that at the Staten-Island dye-house, they had discovered a mode of fixing the Prussian blue so as to prevent its turning green by the action of the fixed alkalies. As this would be a grand desideratum in the art, I felt much interested in the result, and have been anxiously expecting to hear a confirmation of this invaluable discovery. It was made known by Doctor Bancroft, many years ago, that woollen could be dyed blue of a much more brilliant colour than with indigo, by immersing it first in a solution of prussiate of pot-ash, and then in a solution of green copperas; but as it was found that the colour turned to a greenish drab, when it came in contact with any of the alkalies, and as this change was the effect of a law of nature, called chemical action, there has been scarcely any subsequent attempts made, by scientific artists, to fix the colour. As, however, many other discoveries equally as improbable as this, have been made during the progress of chemical science, I was inclined to give credence to theirs, and still hope they have experienced no disappointment.

In England the woad dyers are stationary; the woad is regularly purchased from some celebrated maker who, from long practical experience, has been able to raise the plant, and manufacture it in one uniform way. The lime is obtained from the same

maker, and is always of the same kind and of uniform strength; the ferments are obtained of the same regular quality, and when a dyer is once well acquainted with the art, he is able to work with very few failures, and these are seldom carried to excess. In this country the case is reversed, it rarely occurring that woad can be obtained from two houses of the same strength and quality. Some is raised in America, and some is imported; that which is raised in this country, and much that is imported, being what is called weak woad, which sells in England at fifty per cent. less than that which is strong. The difference in the quality arises from the one being raised on land of the strongest kind, that has been in pasture many years, and the other on arable land, that has been weakened by corn-crops and was probably never of the strongest kind. The lime obtained in the different states is of unequal strength, and does not spend in equal time; the ferments vary according to the state of the stones in which the grain is ground, and to the quality of the madder used; but when all these are uniformly perfect, the woad-dyer has still difficulties to encounter that he never experiences in Europe. There the dying is mostly performed by public dyers, and when vats are out of order, which they are ever liable to be, the operator, quietly and at his leisure, brings them again to work. In this country it is done at factories, and if any thing happens to retard the working of a vat, the operator is looked upon with a suspicious eye, and many disagreeable reflections are thrown out against his capacity, which generally urges him on to hasty measures that frequently produces a total failure.

European dyers have had to contend with another difficulty that is not so easily accounted for. They will, in some situations, be unable to work at all, and in others, will work well for a short period, and then will be unable to proceed without any of the usual defects appearing. An instance of the former case occurred very recently at Pleasant Valley. An Irish woad dyer, who has since proved himself to be a first rate workman, set a vat there and could not progress in the working of it, nor could he in any way account for the failure; the contents of the vat was, of course, lost by him. After sustaining this loss, which amounted, including his own time, to nearly two hundred dollars, he went to West Bloomfield, New-Jersey, where he has been eminently successful. I have undertaken the woad dying at three different places in this country with various success. During the late war I was engaged at the steam factory in Providence, Rhode-Island, where I worked two vats for nearly three years with uniform success. In the year 1821, I went to the West Bloomfield factory, where I worked two vats for several months, without having them much out of order; but the colours were weak, owing to the woad being of bad quality. Soon after the vats were set, I informed the owners they must not expect strong colours, such as were imported. I have since been at

an establishment in Columbia County, State of New-York, where I succeeded for three months, and made very superior colours, but could not afterwards work them. Two or three times I left my vats in good order at night, and found them out of order in the morning, and in a way I had never seen any before. The last day I attempted to work there, I had brought a vat round that had been over limed by forcing it with bran-bags, so as to produce a good green at twelve o'clock at noon, and it kept improving till the last stirring at night; in the morning it was entirely off its work, and appeared like a vat that had been over-limed, although I had given it none. I shall leave it to practical woad dyers to decide how this could happen!!

It is to be regretted that any failure should occur in woad-dying, it having a tendency to bring it into disrepute with the manufacturer, for the colours produced by the ash-dye are so miserable as to stand no competition with the best imported. Blue is a prevailing colour in the United States; it is consequently of more importance than any other, and every effort should be made to bring the woad dying to perfection. It is not probable that good woad-dyers can be obtained from Europe in sufficient numbers to supply so many small establishments as are scattered over this country; they are scarce in Europe, as one dying establishment does the work of a number of large factories, and one woad-man is sufficient for the largest dye-house. It would be desirable, therefore, that a public dye-house should be commenced, and a first rate European woad-dyer employed to do the work, If this were established, the blue wool could be dyed at such a price as would save three or four cents per pound to the manufacturer, independent of paying the carriage backward and forward, which would be a saving of from seven to nine cents on each yard of broad cloth. A public dye-house should be situated where a sufficient supply of water can be obtained for scouring and washing of white wool, and for washing of blue wool. It should be near to some navigable river, and within a short distance of the city of New-York, if intended for that and the adjoining states.

The blues coloured in this country ought to be superior to those imported from England, for the indigo used in the blue vats, is of a superior quality. That which is consumed in England, is of that class known by the name of secondary copperas, here they use the fine purples; the former is a strong working indigo, but is not worth as much as the latter by twenty per cent. There are but few persons who are acquainted with the relative value of the different samples of indigo. In examining several chests held for sale in the city of New-York, I found they asked one shilling the pound more for a quality that was not worth as much for blue dying as others they had valued at a less price. Those who are large con-

sumers of this article would find their account in allowing a small per centage to a good judge to make their purchases for them.

In giving receipts for compound colours, it is difficult so to designate them, that those who purchase the work may have a distinct idea of the hue of each. The dyers three primitive colours, blue, red, and yellow, can be easily described, so as not to be misunderstood; but in the compound colours, this is not so easy, and I have felt the impediment very sensibly throughout that branch of the work. I have endeavoured, however, so to describe them, that every dyer may form an idea of the shade of each as near as can be explained by language. This difficulty must exist in every work published on the compound colours. It has been ascertained, that in cinnamon browns alone there are twenty-two thousand different shades, in nearly all these the yellow predominates, and it is impossible to describe more than three of them in any work published on the art, the light, the dark, and the middling cinnamon; nor can this difficulty be obviated in any other way than by attaching patterns to each receipt, which would make the work infinitely laborious to the author, and so expensive as to be entirely beyond the reach of common dyers. I once had an intention of publishing on such a plan, but I found it could not be sold for less than one hundred dollars for each copy, and that it would occupy a period of five years to complete the work. To obviate this difficulty, I am arranging nearly two thousand patterns in a large book, in regular order, with the design of matching any that may be sent by dyers or manufacturers. To those who purchase dye-stuffs of me, I shall make no charge, but to all others, fifty cents for each pattern that is matched.

I have been requested to give the process of dying hats of a permanent black, but as this branch of dying is out of my province, I cannot presume to attempt it. Hats, when new, are usually a good black, but after wearing a short time, they change to a dirty brown colour. I should apprehend the colour might be fixed so as to be highly permanent by previously boiling them in verdigris and argol, and making use of white oak saw dust with the logwood in colouring them. For the preparation liquor, use with four pounds of verdigris eight pounds of argol, or cream of tartar; boil these two hours before the goods are entered, and then scald or boil the hats the usual time. Put the colour on in a separate furnace, with a liquor extracted from logwood and white oak saw dust in the proportion of twelve pounds of saw dust to ten of logwood—blacken with copperas as usual. This mode of dying, will not require any nut-galls. Should the colour be too much on the blue, use a small quantity of alder bark or sumac. The hats will have to be washed after preparing, and before finishing. If white oak saw dust cannot be easily obtained, they may be finished in

the usual compound, leaving out the verdigris. Any number may be primed in the preparation liquor, which will not injure by being kept for months.

From experiments made with the wild indigo plant, I have recommended its use in a state of decoction for the woad vat, in place of swill from bran and madder, and to fill them up, when lowered, by working. Mr. Jollie, a dyer at the Steubenville factory, Ohio, has just informed me that he has tried it according to directions given by me, in the Statesman of last year, and have found it highly beneficial. He says the vats work steadier, more vigorously, and produce a finer colour than with the old mode of working. He gives to those who gather the plant, five dollars the ton, delivered at the factory, which is only one-fourth of the price of bran. Dyers will therefore find it a valuable succedaneum upon principles of economy, independent of the colour it affords.

I am indebted to a friend for the article on bleaching by the chemical process. The gentleman from whom I obtained it, is more scientific than usually falls to the lot of practical artists, and to this cause I am probably indebted for the promptitude with which my request was granted, and for the liberal permission to make use of it in any way most advantageous to the public.

TREATISE, &c.

ON THE MANAGEMENT OF WOOLLEN FACTORIES.

IN England the woollen factories are undertaken by persons who have a competent knowledge of the business, having been either apprenticed to it, or instructed by their parents, who had followed it before them. In this country, the capitalists who embark in such concerns, have no knowledge of the business, and, in many instances, they employ managers nearly as ignorant as themselves.

Can any concern be expected to flourish under such circumstances? It is true they may flounder along for a few years, and if the manager be an ingenious and enterprising character, and disposed to apply all his time and attention to the business, he may so improve as he goes along, as to keep pace with the best the country affords; but the greater number will be sure to fall through, and this has already been the case with too many.

Englishmen were generally employed to manage these concerns when they were first started, most of them only partially acquainted with the business; but they were willing, with that presumption which is a prominent ingredient in the character of the greater number of manufacturing workmen, to undertake the management of those parts they were ignorant of, as well as those with which they were acquainted. The result has been, that English managers are in disrepute, and their pretensions are so much doubt-

ed, that the most able English manufacturer, should he emigrate to this country, would find it difficult to persuade the trade that he understood any thing about it.

It has happened unfortunately that very few who are generally acquainted with this manufacture, have emigrated to America. I have known but four from the west of England—one of them is in partnership with the Messrs. Youngs, of Brandywine, another is managing for Mr. Shepard, of Massachusetts, and the others reside in New-York, unemployed in that way—such men would do all that could be performed towards placing our manufactories on a par with the English.

The manager of a woollen factory should always be in the business, nor ought he to be engaged in any other pursuit that has a tendency to draw his attention away from it; he must examine the work as it comes from the hands of every workman, and must be able to distinguish good work from bad, nor must he permit any defective work to pass without censure, and a fine, if such is, as it ought to be, the rule of the factory. A manager who cannot discriminate between good and bad work, will be compelled to leave the inspection to secondary managers whose qualifications he cannot appreciate; and it is more than probable that he will be the tool of some smooth designing knave who knows very little more than himself. This state of things will keep such a concern stationary; all improvement will be checked, and no progress can be made towards perfection. Other factories in the mean time will be improving in fabric and reputation, and leave this so far behind, that the concern will gradually droop and linger until the persons concerned shall either give up, or be ruined.

Under the direction of an ignorant manager, bad workmen will be encouraged because they cringe to the overseer, whilst good ones will be soured, and dismissed, for displaying a spirit of independence. A good workman will not be found fault with when he is conscious that he has done better than others whose work

has been approved. This state of things will cause him to complain, and complaint is always considered impertinence by an ignorant manager. As such a director must be conscious of his own inability to decide, he is ever fearful that a good but discontented workman will expose his ignorance, and thereby cause him to lose his situation—the dread of this often induces him to part with his best hands, very much to the injury of the concern.

It is useless to dwell any longer on the bad effects of ignorant management, as every tradesman must be aware of its ruinous consequences. It may be necessary, however, to give a clue by which the capitalist can discover when he employs an ignorant manager, and this may be known in a very simple way. A factory that is under the direction of a man well versed in the business, will be constantly improving until the goods are perfectly made; whereas, under the management of an ignorant director, it will at least remain stationary, if it does not retrograde. The one will be drawing around him the best workmen, whilst the other will be collecting the worst. The ignorant manager will be so conceited as to think himself superior to all others, before he is at all acquainted with the business. He will consider and pronounce the fabrics made under his direction, to be superior, when their inferiority is visible to every other person who is the least judge of the article.

ON EMPLOYING OF WORKMEN.

IN the infancy of any description of manufacture, it will be necessary to employ European workmen; but native workmen are made as it progresses, and foreign aid may in a few years be dispensed with. The settled population of the neighbourhood in which a factory is seated, should be employed in preference to workmen from adjoining counties or states.

In the west of England the woollen factories are located in small districts. In the county of Gloucester it is all done within a circle whose diameter shall be fifteen miles, within which more than forty thousand hands are employed, and these are almost all of them natives of the place, whose fathers and grand-fathers followed the same business before them. By this means, local habits and prejudices are acquired, which operate more powerfully to confine them to their district and calling, than could be enforced by the most tyrannical laws.

In America, these factories are scattered over a great extent of country, and in general, the workmen employed in them, are itinerants, having no local attachments, and the consequence is, that they are continually roving from one factory to another, very much to the prejudice of the whole. In order to remove this difficulty, it will be necessary to instruct the heads of families brought up in the vicinity of factories, and to give employment to every capable individual of each family ; also, never to engage a workman unless he brings with him a character from the place where he was last employed. At present a workman finds no difficulty in getting employment, should he have made bad work in one factory, or be discharged for drunkenness, or gross immorality, or even for theft; the only loss he suffers is a march of from ten to fifty miles, and he is certain of finding another situation equally good, without any reference being required of him as to ability or character. Should this mode of engaging workmen be continued, the growth of the manufacture will be retarded more than the owners generally are aware of. On the contrary, if the managers would mutually agree to employ no strange workmen without recommendations, and when they part with them, would give in return a fair and candid character, that itinerancy of which they so much complain, would be sensibly checked.

The workmen of this country acquire a knowledge of mechanical and manufacturing operations with much greater facility than Europeans, and when the managers shall have obtained a compe-

tent judgment in this business, and will pay that strict and constant attention which so complicated a manufactory requires, the American workmen will become as expert as any in the world; but so long as the managers are satisfied with inferior workmanship, and are negligent in inspecting defects, so long will the workmen continue below mediocrity.

English workmen do not perform as well in this country as when in England. They find the managers generally ignorant of the business, and they take advantage of this circumstance to neglect their work, not by being idle, for that would not answer their purpose, but to expedite it at the expense of the quality, and this is no more than they do in England, when they find a master either ignorant or inattentive. Weaving is one of the most important branches in a woollen factory, and if the workmen find they can earn twenty-five cents a day more by slighting their work, than by performing it faithfully, and that the person examining it does not understand good work from bad, it is but reasonable to suppose they will make bad work; for it is well known, that bad workmen in general, will make as much out of their employers as they possibly can, without considering whether the means be fair or unfair.

There is a law in England, now become obsolete, which compelled the woollen manufacturer to put out his weaving to master weavers, who have shops in, or adjoining their houses. Many of these will keep from four to ten looms at work, finding their own looms, gearing, harness, and reeds, and are allowed from *one shilling to eighteen pence an ell, according to the quality, for broadcloth, and from †eight pence to one shilling for cassimere. These master weavers employ journeymen, and instruct apprentices, but

* From twenty-two to thirty-three cents.

† From fifteen to twenty-two cents. An ell is one yard and a half. In Yorkshire, the weaver of broadcloth is paid forty-four cents for three yards and a half.

they are always answerable to their employers for bad work. Although this law is not considered as binding on the clothiers of the present day, yet the system is continued, because it is considered better than having the weaving done in the factory. Many of these master weavers live in houses of their own, around which they own land enough for large gardens, and for pasturing their cows and horses, and are not unfrequently in possession of tenements, which they rent to their journeymen. If this plan were adopted in America, the master workmen and their families would become stationary; for when a man owns looms, harness, and reeds, with houses and land, it would be no slight matter that would induce him to break up, sell off, and seek out for some distant situation, where the chance would be that he could not better his circumstances. This system would be beneficial to the capitalist, independently of keeping the workmen in their place, and if spinning also were included, the saving would be still more considerable.

The buildings erected here for woollen factories are very large and expensive for the quantity of work done in them, and the weaving and spinning occupy the greater part of the room. If these branches were performed by workmen, at their own houses, the capital expended in building of mills, need not be half what it is at present; and should this part of the capital be laid out in erecting suitable rooms under the houses intended for workmen, every requisite convenience would be secured, and an ample interest received for the money expended by way of rent. Thus a dead, unproductive capital would become productive, bearing an interest of seven or eight per cent, so long as the factory continued in operation.

It is very unusual for the west of England manufacturers to employ workmen from Ireland or from the north of England, and *vice versa*. This may appear very strange to those unacquainted with that country; and yet the principle on which this election is grounded is very reasonable: the description of cloth made—the machinery used, and the mode of working is different in all those

places: add to this, that the workmen have strong prejudices against each other, and the reasons why they do not intermingle will become very obvious.

The workmen from Yorkshire are excellent carders, slubbers, and spinners, and are more conversant in the general concerns of a factory, than are those from the west of England; but as the fabrics made in the north, are mostly of a coarse quality, the workmen are not generally as well acquainted with the making, dressing, and finishing of fine goods.

I would recommend the manufacturers of this country to select their foreign workmen from one of the three, but never on any account to employ a mixture of them in the same factory—either of these may be made to agree with American workmen, but never among themselves.

I cannot conceive a more uncomfortable situation, than for a manager, who is not perfect in the business, to be surrounded by a mixture of Irish, Yorkshire, and west of England workmen. Whatever advice he might receive from the one party would be condemned by the others. If any description of machinery were recommended by the one, the other would be sure to suggest something different as being better; their opinions on spinning, weaving, braying, fulling, raising the nap, shearing and pressing, and packing, would be all at variance with each other, and it would be much if the manager did not make his election from the worst of the three. I know manufactories that are now labouring under this dilemma, and all of them have suffered more or less in the same way. A few years, however, will remove the injury arising from this cause. It is only to make and encourage American workmen, and the evil will be gradually receding.

ON MACHINERY.

THAT the best of every description of machinery should be employed in this country, to enable its manufacturers to compete with the importer, is a fact so obvious, that to mention it would appear almost superfluous; yet this is far from being the case, and it is probable the reason why it is not so, has never been suspected by the American capitalists.

I hesitated when I commenced this article, whether to explain this circumstance, or pass it over in silence, but the wish to promote the growing manufacture of the country, and knowing that the longer an evil was continued, the more difficult it would be to eradicate it, overcame every other consideration, and induced me to make it known.

It is then an indisputable fact, that the cause of the emigration of many English workmen, from the woollen manufactories, has been occasioned by their objection to the introduction of certain machinery into the counties from whence they came; and some few of them left, because their violence in attempting to prevent it, made their stay there very hazardous. This prejudice against machinery is still very strongly entertained by them, and is not unfrequently expressed.

How happens it that in many of our factories, the nap is still raised by hand, at an enormous expense?—that where the gig-mill has been introduced, it is so constructed, and so slow in its motion as to defeat the purpose for which it was intended? These impediments may sometimes have occured from the ignorance of managers, or from a want of knowledge in the workmen who gave directions; but it has been suspected to be the result of that violent antipathy against this mode of working which English workmen bring out with them.

Although this prejudice might be excusable in England, inasmuch as the introduction of machinery there occasioned many hundreds of workmen to be thrown out of employment, without means of obtaining it elsewhere; yet in this country that prejudice cannot be sustained on any plausible pretence, for the manufacturer here must fall, unless the cheapest and best modes of working be adopted. If it cost the American manufacturers fifty dollars to raise the nap on a given quantity of cloth, that might be better done for ten, can they be expected to compete successfully with the importing merchant, and shall English workmen be so blind as not to see, that every effective labour-saving machine introduced into her manufactories, is ensuring a continuation of their employment instead of injuring it?

The jennies used in England, at least in the county of Gloucester, are mostly of eighty spindles, and never less than seventy, whilst in this country, the largest have only sixty spindles. This is certainly retrograding in the use of labour-saving machinery; for it has been proved by comparative experiment, that four persons working on eighty spindle jennies, will turn out as much yarn per diem, of any given fineness, as five would on sixties. I have mentioned this difference to several factory managers, and the answers uniformly received, have been that sixties were as profitable as eighties; but I would ask from whence had they this intelligence? Surely not from personal experience, for I have never heard of an eighty in the country. Another objection urged against eighties is, that the labour would be too great for the workmen; if this be fact, it must speak volumes against the success of the manufacturer, and would prove what many naturalists have asserted, that on this continent man degenerates in physical strength. In England, eighty spindle jennies are worked by women; in America their sixties are worked by men; and shall it be said, that the women in England are stronger, and capable of doing more work than men are in America? Those who read this, will perceive that it is rather an excuse than an objection; the persons who made it, never saw an eighty spindle jenney, nor had

they any data by which to judge of the difference, and the only support for their observation must have been founded on the representation of English workmen. It must be evident that the jennies are either badly constructed, or that the managers have been deceived.

Since writing the above, I have seen jennies of one hundred spindles and upwards, that twist by water. At first sight, I considered this mode of working to be a great improvement, but from experience I am inclined to believe they cannot be made to perform as well as when the twist is given by hand, particularly for spinning of warp. Good spinners have informed me that the twist requires humouring in some parts of the draft; that when worked by hand, they can humour it as they find the wool draws, but that when twisted by mechanical power, it must have an equal portion in all parts of the draft. Whatever may be the cause, it appears from the little experience I have had in spinning by mechanical motion, that the same quality of wool will not draw to as fine a thread, when spun in this way as it will when worked on the hand jenny.

ON THE WASTE MADE IN FACTORIES.

THE first object that strikes an European in going over any American factory, is the great waste of stock. In the first place, before he enters the building, he will see a large heap of waste of every description deposited near the factory, in which raising and shearing flocks, locks of scoured and unscoured wool, flakes from the carders and scriblers—pieces of copts, &c. &c. are all mixed together: that which is real waste being intermingled with valuable stock of all qualities, and from every department. On examining the dying flakes, he will see locks of coloured and white wool, laying all around and underneath them; some loose on the ground, others almost buried by having been trodden under foot,

and not a few nearly drawn into their holes by the worms. The same destructive carelessness is observable in the interior departments; and finally, in walking round the exterior of the building, he will see pieces of copts and bobbins lying under the walls, that have been thrown out of the windows.

Such destructive waste is a source of great satisfaction to those foreigners who are hostile to American fabrics, and I have seen this wasteful system animadverted upon in English periodical publications, and the fall of the manufacture prognosticated as the result.

It is curious to observe how ready the managers are in offering excuses for any defect pointed out to them. In this instance they will tell you that the difference in the price of labour will not allow of their being so particular here, as they are in England. Provided the saving of stock was attended with additional expense, it might then become a matter of calculation whether or not it ought to be incurred, but this is not the case: it is only necessary to make every one employed in the factory, men, women, and children, answerable for all unnecessary waste, and the loss now sustained, would soon be retrieved without any additional expense.

Separate bins should be provided and legibly marked for each kind of waste, and the workmen compelled to deposit what belongs to their department in its proper place. At convenient opportunities this should be looked over, and appropriated to such purposes as it is fitted for: the odd locks, the slubbing and filling waste, and that from the carders and scriblers, may be worked into filling for mixed broadcloths or sattinets; the chain waste will make handsome hearth rugs, in imitation of the Turkey, the mill puffs, gig-mill flocks, and burling nips, after being willowed in baskets made for the purpose, are excellent for stuffing of couches, or filling of beds; the shearflocks make superior stuffing for horse pads, and the thrums may be made into mops, a convenient article for cleaning house floors.

Such is the manner of appropriating waste in England, nothing is lost there, every thing, however trifling, being turned to some profitable use. In America, it is generally thrown out and permitted to rot, or carried to the fields and gardens as manure.

I have pointed out in a general and summary manner, the bad consequences of mismanagement; the injurious effects resulting from the itinerancy of workmen; the inefficiency of some parts of the machinery; and the loss sustained from excessive waste, and have endeavoured to show how these defects may be remedied. I shall proceed to treat of each operation belonging to the manufacture in their regular order:—the choice of wool, sorting, picking, scouring and washing, drying, willowing, oiling, scribling and carding, slubbing, spinning, warping, weaving and bobbin winding, braying, burling, fulling, raising the nap, drying the cloth before burling, and after raising the nap, oiling, shearing, linting and pressing and packing.

An opinion prevails among managers, that provided a few of the leading operations are well performed, the others are of little or no consequence: this opinion is erroneous and very fatal to those who entertain it. Nothing can be more certain than that in making perfect superfine cloth and cassimere, every operation, however trifling, must be well understood by the manager, and perfectly performed by the workmen. It may be said that workmanship of this description will be too expensive, more than the price of the goods will bear; but this idea also must be founded on conceptions that display a total ignorance of the business. How is it that the cloth made in one factory, from a given quality of fine wool, will sell for two dollars a yard more than that which is made from the same quality in another? It is because the person who manages the one has a competent knowledge of the business, and takes care to have every part well performed, whilst the other is either ignorant, or neglectful. The difference in the expense of having every part well, or indifferently executed, cannot exceed twenty

cents on the yard, whilst the increased value will be more than eight times that amount—how very blind must those managers be to their own interest, who can view with indifference, operations so pregnant with profit to their concerns.

It will be my aim in commenting on these operations, to give all the information within the scope of my knowledge. As this was obtained in England, I shall often have occasion to revert to that country, to inform my readers of the modes pursued there: I do not profess to be acquainted with the making of woollen goods generally, my experience and information having been obtained in the county of Gloucester where none but superfines are made, and my observations, therefore, must be considered as applicable only to those qualities. How far perfect workmanship may be deviated from in making goods of minor qualities, I cannot determine; but should infer, that in all cases it ought to be as perfect as the price of the fabric will allow of.

ON THE CHOICE AND PROPERTIES OF WOOL.

The wool used in this country is either of American growth, or imported from Spain and Portugal. The Portuguese wool is not in much repute any where, it is a wiry, harsh, foul wool, and with few exceptions very unfit to be used for any thing like superfine cloth. Since Saxony wool has been used in England, the Spanish has sunk so much in reputation as to be seldom employed in making prime or even secondary superfines. Take two lots of wool, one of Saxony, the other of Spanish, of similar quality, and the cloth made from the Saxony will be very superior to that made from the Spanish; the former will have a much finer face, will handle better, and sell at a higher price.

The wool imported into this country from Spain is generally of an inferior quality for the marks: indeed I have seldom seen a

good sample of single R here, and nothing less than a prime wool of that mark, ought to be used for superfines. That which is made from prime single R for chain, and good double R for filling, would be worth, if well manufactured, from six to seven dollars per yard.

Spanish wool, as mentioned in the Statesman of the last year, is sorted and scoured soon after it is sheared, and is seldom used in less than twelve months afterwards, and many lots lay two and three years before it is manufactured. Those who are at all acquainted with the properties of wool, must know, that the staple will be gradually injured after it has been scoured: it will become harsh, and brittle by age, so much so, as never to recover that fine elastic property, in which its value principally consists. It is true that when closely packed as Spanish wool is, it is not injured so rapidly as when left open; yet that it is injured by age, is well known to every experienced wool dealer and manufacturer.

The full blooded wool of this country bears a strong resemblance to the Saxony, and I have seen small lots offered for sale, the first quality of which ought to have made cloth worth ten dollars a yard; but I am informed that the fleeces do not contain as great a proportion of fine wool as the Saxony.

To improve the quality of a flock, it is necessary to examine the lambs when their wool is a little grown, and if any are found having coarse fleeces, they should either be sold, or sent off to an inferior flock; but should the increase be permitted to go on without sperating those having inferior fleeces, the quality of the wool will degenerate rather than improve. It costs no more to feed a fine fleeced animal than it does a coarse one; and those agriculturalists who raise sheep with a view to profit, would certainly find their account, in obtaining by means so easy, a flock whose annual fleece would be worth thirty per cent. more, than when raised after the common careless manner.

It is not many years since fine wool was exported from Germany, and I have understood that they first obtained their sheep from Spain during the late continental war, and about the same period, they found their way to New South Wales and America. Germany and New South Wales are now supplying Europe with much finer wool than can be obtained from Spain, whilst America raises very little that is equal to the best of the second quality Spanish. There must be some radical defect among the wool growers of this country that loudly demand to be remedied.

Our manufactures are now arrived to that state in quality and magnitude, which makes it advantageous for each one to confine itself to the making of one or two qualities of cloth. By pursuing this mode, perfection would be obtained much sooner than by following too great a range. A factory that is put into operation, with a view to the making of fine goods, must be injured, and rendered unfit for that purpose, by manufacturing those of a quality very inferior. It is also very inconvenient, as the mode of working in every department must be different, and the manager must be continually making new calculations to regulate the work.

To give manufacturers an opportunity of working only one or two qualities, it is necessary they should be able, at all times, to purchase asupply of wool of such as are wanted; otherwise, their factories must sometimes stand still, and this state of things would be worse than the former. I believe it is difficult at this time to obtain a supply of one or two qualities. When American wool is purchased, they have to take it in the fleece, and to work up all the qualities: now it is evident to every one conversant with this manufacture, that those cards which are calculated for choice locks, and the reeds and harness that are made for such work, are not fit for working the coarsest grades, and vice versa.

In order to obviate these difficulties, it would be desirable to

have the fleeces stapled by dealers in wool, so as to enable manufacturers to purchase the qualities they may want; but the principal thing wanted is extensive capitals, vested in the wool trade, to purchase domestic and foreign wool of every quality, and in sufficient quantity to supply the market. Agents, who are judges of the article, should be employed in Spain and Germany, to make such purchases as the present and increasing demand may require.

It is to be regretted that it should be necessary to resort to importation for the supply of an article that might be raised to any extent in this country, and which, while it improves the land, affords a good profit to the agriculturalist; nor would this necessity be of long continuance, provided the farmers would generally turn their attention to the merino breed, and take the same pains to obtain fine fleeced animals, as is done by the Spaniards and Germans. At the present time, the factories are increasing more rapidly than the flocks; but so soon as the former shall have acquired their maximum, the latter will continue to increase until it be in excess.

To possess a good judgment in wool, requires more practical skill than manufacturers are generally aware of. An English clothier who is known to have a correct and discriminating judgment in this article, is often employed by others to purchase their wool, for which he is allowed a small commission. So trifling are the profits in that country, that unless the wool is well bought, the cloth will afford none; and though the profits are much larger here, yet the success of a manufacturer must depend in a great measure on having a good judgment in purchasing the raw material. I do not profess to have a perfect knowledge of wool, and if I had, it would be impossible to give such written instructions as would convey it to others, I will endeavour, however, to point out some of its leading features,

It will be understood that perfect wool is flattish rather than round; that when round, it approaches nearer to the properties of hair than of wool; that when of a proper shape it is finer as it is thinner and smaller; that when fine and good, it will have a crimped appearance, which makes it look shorter than it really is; that it will have a glossy surface, somewhat resembling silk; and that when stretched out, it will be sufficiently elastic to return to its former position, like a steel spring, as soon as the stretching power is removed. When a lock of wool is placed close to the ear, and there gently drawn out, it will make a crackling noise; and some judgment may be formed of its quality by the noise it makes—all wool will give it more or less, but the finest will make less noise than that which is coarser. When the fingers are drawn from the roots to the points of wool, no sensible resistance is felt; when drawn from the points to the roots, the resistance is very sensible, but less so as the quality is finer.

It must be evident that it will require considerable practice to become expert even to the extent of these few instructions, and much more must be acquired before a correct judgment can be formed. It is difficult in all small articles, where there is a great range in grade and quality, to be able to discriminate between two samples nearly alike, and this can be acquired only by practice. Those managers who are desirous of improving the quality of their cloth, and to make large profits, must take every opportunity of comparing different samples and remarking the result when made up with their judgment before hand; by these means they will be able in two or thre years to discriminate accurately between the relative value of samples that may be offered for sale. Many English manufacturers employ a small pocket microscope to examine the samples of wool before purchasing; and it is said the quality can be better ascertained in this way, than with the naked eye.

In purchasing of wool it is not only necessary to attend to the quality, but also to its condition. Spanish wool is partly scoured

before it is exported, but some lots are scoured much cleaner than others, and it will be necessary for the purchaser to ascertain how much will be the probable loss on the different samples. Besides this defect, Spanish wool is often very badly sorted, and left with all the burs and pitch marks remaining in it. This wool loses from ten to eighteen per cent. in scouring.

Saxony wool is offered for sale as it comes from the sheep's back, having been merely washed before shearing, and is afterwards sorted, yet some samples are much fouler than others—the average loss by clean scouring is about thirty per cent: at least this is the per centage allowed by the manufacturers when they send their wool to be dyed—for every hundred pounds of Saxony wool sent to the dyer, they expect to have seventy pounds of clean wool returned. American merino wool, unwashed before shearing, will lose from forty to fifty per cent. I once had two fleeces of unwashed wool scoured, from sheep that had been feeding on sandy land, one of them lost fifty-six, and the other fifty-eight per cent. The finer the quality of the fleece, the more it will lose in scouring, because fine full blooded wool has more yolk in it than that which is of inferior quality. American wool that has been washed clean before shearing, will lose from twenty-five to thirty per cent.

SORTING, OR STAPLING OF WOOL.

I mentioned in the last article that it would be better that the wool should be stapled by the dealer rather than by the manufacturer, and no doubt such an arrangement will take place in a few years; for want of it an intricate branch is thrown on the managers of factories, which could be better done by persons whose whole attention would be applied to this in particular.

Wool should not be thrown into too many sorts; this is useless as it regards the quality, and troublesome to those who have to work it

up: four or at most five qualities are sufficient for any fleece of fine wool, and three for coarse wool.

After a lot of wool has been thrown into sorts by the stapler, it should be carefully examined by the manager to discover if he has thrown them regularly, for when stapled by the pound, as it generally is, it will be the interest of the workmen to throw it out in a very rapid and careless manner, by which he will be able to earn thirty or forty per cent. more, than when he has sorted it carefully, and with due regard to the interest of his employer.

Spanish wool is packed in very coarse bagging, and much of the lint from the bags adheres to the wool that lies next to it. This covering should be taken off without breaking the wool, and all the lints and filth from the bag carefully picked off from the outside, before the mass is broken: should this be neglected, the cloth will be very linty, and much expense subsequently incured in having them taken out by the women whose business it is to spoile the cloth. This wool is often badly sorted, so much so, as to make it necessary to have it looked over and the coarse locks thrown out. It is not requisite to employ a regular stapler for this purpose, as it can be done as well by any steady girl from the wool pickers.

When wool has been sorted, it should be sent to the pickers to have all the burs and pitch marks taken out, and if American wool, the dead ends cut off, which should be done with as little waste as possible. It is now in a state fit for scouring.

SCOURING THE WOOL.

THIS is an important operation. much more so than is generally imagined by those who are not well versed in the art of manufacturing, for unless the wool be well scoured, and thoroughly cleansed from the yolk and grease, the subsequent operations will

be materially injured, as good cloth never can be made from wool badly scoured.

English manufacturers are so much aware of the advantages of good scouring, that better wages are given by them to a good workman in this, than in any other branch of the factory, and he is more certain of finding steady and constant employment, whilst a spinner can earn only two shillings and six pence a day, a wool scourer will make four. He usually works by the pack, of two hundred and forty pounds, as weighed in the grease. When employed by the day it is considered a day's work for him to scour and wash that quantity; but when engaged by the lump, he will scour and wash from one and a half to two packs. To enable him to do this, every thing must be conveniently arranged.

For scouring, a shallow conical furnace is employed, holding about two hundred gallons, which may be made either of copper or of iron. It is set in brick work as other furnaces are; but the fire is never permitted to reach more than one third of its height.

The apparatus used for washing of wool, after it is taken from the furnace, is uniformly of an oblong square; but they are constructed of different materials, and variable in the mode by which the water is applied. Some are merely willow baskets, others are made of timber in the bottom and sides for about half their height, the upper part being constructed of strong open wire work, with a wooden curb round the top. Some few are made entirely of sheet copper, with holes perforated about half way from the top downwards: these are always placed in running streams where the water is not too rapid, such as mill ponds, or tail races. The race which in this country leads the water from the dam to the wheel would answer well for this purpose, where the water has a sufficient current. The current should be strong enough to keep the water inside the basket continually changing, yet not so strong as to drive the wool too hard against the side opposite to where it enters, which will be attended with considerable delay and trou-

ble, as well as with a loss of wool, as many of the fine locks will be washed through the wires, or other openings.

An apparatus superior to either of the above is now generally used for washing, where a head of water, from four feet upwards, can be obtained. The shape of this is also an oblong square, and for a full sized washer is five feet long, two feet three inches wide, and the same in depth: a stout false bottom is added about three inches above the real one—in it are drilled an indefinite number of small holes, three eights of an inch in diameter, and the water is conveyed in between the two bottoms by means of a two inch pipe, in which a cock is placed to stop the supply when necessary. A number of small holes are drilled in the ends and sides of the washer for twelve inches from the top to let the foul water run off. When the water is turned on, it will be forced up with a power equal to the weight of the column, which is sufficient with a fall of six feet to keep it in a constant strong boiling motion. When scoured wool is thrown into one of these machines, it is kept floating and rapidly moving on the surface of the water, by the upward pressure of the column, and the foul water passes off through the holes on the top. The workman stands on one side of the washer and moves the wool backwards and forwards with a jerking motion, by means of an iron prong, until the water passes through it perfectly limpid; when he throws out that quantity and replaces it by another, and so on alternately until the days's work is finished. This mode of washing wool is superior to every other, the work is performed in less time, and the wool more completely cleansed.

In constructing this machine, it is necessary to be guarded in two particulars; first, that the united capacity of the holes drilled in the false bottom, be not quite equal to deliver all the water supplied by the column; for when this happens, the supply will operate partially, and the designed effect be in a great measure destroyed. In the next place it is necessary that the holes drilled around the basket, to let off the foul water, be sufficient to let off all that the column shall supply, when the wool is in the basket,

without permitting the water to raise within two or three inches of the top: unless this be attended to, the water will flow over the washer and take the wool with it.

Many crude notions respecting wool scouring, have been advanced in this country since the woollen factories commenced, and injurious modes of preparing the scouring liquors are now in operation. A plan for making cloth, without scouring the wool, was started a few years since, supported by the plea that the natural grease of the animal was as good as oil, and this absurd idea found many advocates, until experience convinced them of its injurious tendency. The supporters of this theory did not appear to know that a single fleece of full-blooded merino will contain a considerable quantity of silecious sand, that when worked in the cards, would injure them; nor were they aware that wool worked up with forty per cent of yolk and grease, would, when the cloth was scoured out after weaving, leave a cloth quite thin that was well filled in the loom.

There are but few American factories where scouring of wool is completely understood. In general, the liquor is not made strong enough to decompose the whole of the yolk and grease; when this happens, the wool will turn yellow in drying, and on handling it when dry, it will feel greasy, a portion of the grease adhering to the hands so as to make them sensibly oily. When wool is coloured in this state, the colour does not look so well as when it has been well cleansed, nor will it stand scouring, or wear as well when made into garments. This is a serious injury to the manufacturer, as it has a tendency to bring the American cloth into disrepute, and to lower its value in comparison with foreign fabrics.

Urine is the only material that ought to be used for scouring of wool: it is the cheapest of any, and can be obtained in sufficient quantity in almost any situation in which a factory may be placed. The volatile alkali, that part of urine which combines with the

yolk, does not injure wool unless it be in considerable excess, or too much heat be applied; whereas the fixed alkalies operate so powerfully as to dissolve a portion of the wool at a temperature that will scour it.

Urine that is fresh voided, will not scour well. That from persons living on plain diet, is stronger and better than from luxurious livers. The cider and gin drinkers are considered to give the worst, and the beer drinker the best. When the urine is collected, it should be kept in close vessels until it has completely undergone those changes by which its ammonia is developed. Many English manufacturers keep it in large vats with close covers, and I have seen six of these at one factory, holding nearly two thousand gallons each, all full: they keep working the oldest and filling up as they are emptied.

Those who would wish to become acquainted with the component parts of what has to be removed from wool, and of the properties in urine by which they are to be removed, may consult Vauquelin's Analysis of Wool and Urine. They will there see, that nine-tenths of the salts of fresh voided urine are acid; whilst in a stale state, they are altogether alkaline, eight-ninths being ammoniacal. The material to be detached from wool is principally an animal fat, which forms a soponaceous compound with the ammonia of the urine, which will readily wash out in water. The ammonia, if any remains about the wool in an uncombined state, is so volatile, as to escape while the wool is drying, leaving it free from oil or salts. When the practice corresponds so exactly with the chemical analysis, it proves that the operation pursued by the manufacturer has attained its utmost degree of perfection.

To make a new liquor for scouring fine wool, use one bucket of urine to two of water. Some wool requires more and some less of urine; if too much is used, the wool will be stringy and difficult to work; if too little, the yolk and grease will not be

cleansed out of it. The same proportions of urine and water as are used in making a new liquor, should be employed in filling up during the progress of the work. The urine should be old, and the water the softest that can be procured. It occasionally happens that a liquor, when fresh made, will not scour well; whenever this occurs, mix one or two quarts of soft soap in hot water, and add it to the liquor; but this should never be done if the menstruum will scour well without it.

When a liquor is properly prepared, a frame with cross bars must be placed over the furnace, resting on the curb; this is intended to receive the wool when taken out of the scouring furnace. As much wool is immersed in the scouring liquor at once as will work easy therein; when entered, it requires to be worked backwards and forwards for the space of five minutes, and to remain in altogether from fifteen to twenty-five, according to the rapidity with which the yolk and grease is dissolved. To know when the solution is completed, take a handful from the furnace, squeeze the liquor well out of it, and wash it in water. By examining this sample, the workman can see whether or not it be clean. When clean, take it out of the liquor and throw it on the cross bar over the furnace, and let it lie there ten minutes for the liquor to drain; then have in another quantity, and work in the furnace as before. There should be enough scoured at once for three washings, which will save much time that is now lost at the scouring furnace. Wash as before directed, till perfectly clean.

The scouring liquor should not be too cold nor too hot, the proper temperature is from one hundred and twenty-five to one hundred and thirty degrees, Fh. and it ought never to be lower than one hundred and twenty. If the wool be immersed in too hot a liquor, it will be slammed, as the workmen phrase it—that is, it will become matted and stringy, and the yolk will be so permanently fixed in it, as to be immoveable by any subsequent process. When, therefore, a new liquor is made, and also every morning before the work begins, let the workman take a handful of un-

scoured wool, and dip it five or six times in the liquor, working it each time backwards and forwards, and then wash it to try if it be clean ; if the sample does not scour well, the heat must either be raised or lowered, and if this does not produce the desired effect, the error must be either in the strength or weakness of the lixivium, and more urine, or more water must be added, according to the experience of the workman.

There are three chemical operations in a woollen factory: the scouring of the wool, the dying and the braying. Manufacturers would find it much to their advantage to require such a knowledge of the science as to understand the rationale on which these operations are founded, as it would often prevent them from attempting experiments that are highly injurious to their interest. Persons acquainted with the theory, would never scour wool with potash, or any of the fixed alkalies ; they would know that greasy wool could never be coloured with any credit to themselves, or to the dyer they employed, and they would be aware that warm water and soap would not answer in braying, or that operation by which the grease and size are taken out of cloth after weaving.

When wool has been scoured, that part which is to be coloured is sent to the dye-house, and that which is intended to be dried for white work, is spread out on sheets, or platforms, and exposed to the sun and air. I shall treat fully on the drying of white and coloured wool in this place, which will make it unnecessary to revert again to the subject.

DRYING OF WOOL.

THERE are three modes of drying wool, one by open exposure to the sun and air, another by a fire stove, and a third by an air stove. It would be found useful by manufacturers who have large

concerns to have both an air and a fire stove. The latter would be wanted in the winter, and the former in the summer.

In England the wool fire stove is a circular building, either of brick, or stone, of about sixteen feet diameter in the clear, containing three floors, the height of each being eight feet. The two upper floors are laid with strips of well plained inch board, two inches on the face, and sufficient appertures are left between the strips, for the heat and steam to pass, yet close enough to prevent the wool from falling through. It is heated by a cast iron stove three feet high, in diameter two at the bottom, having a dome top, and open at the lower end. In the centre of the top is a circular opening of eight or nine inches diameter, in which is inserted a cast iron pipe, that passes perpendicularly through the centre of the building, and terminates three or four feet above the roof: a sufficient space is left round the pipe where it passes through the floors and roof, as to prevent any damage from the fire; and at those places the pipe is steadied by iron rings around it, and arms branching from them which are fastened to the floors and roof. The iron rings are large enough to admit the pipe, and leave a space of one inch between the two, so as to admit of the pipe being taken out when by any circumstance it should be rendered necessary, as well as to cut off the communication between the two, in order to prevent the heat from being conducted along the arms, by which the safety of the building might be endangered. Three wedges with bent tops are dropt in between the pipe and each ring to keep the pipe exactly in the centre. The lower floor is paved either with stone, brick, or cement; and the stove is placed exactly in the middle of the building, being raised a few inches on brick work, having a grate at the bottom to let the ashes through. The interior of the building is fitted up with convenient machines for drying wool. These are made with shafts three inches in diameter, cut in six sides, in each of which, inclined holes are made to put in arms that project about twenty inches from the shaft; these are round and smooth, being about one inch at the bottom, and tapering to the other end; they are made of any hard well sea

soned wood, each one having an elevation from the shaft of about twenty degrees, and when the whole is in place, it has a spiral appearance. On these arms the wool is spread to dry. One circle of armed shafts is placed round the wall, and as near to it as they can be without coming in contact, and another circle between it and the stove, two circles on each floor, with room between the two for a man or boy to pass, for the purpose of putting on and changing the wool. The arms are not permanently fixed in the shafts; they go in loose, but so as not to fall out when the wool is put on, or handled for turning. The shafts are secured in the lower side of the upper floor by means of a round apperture that is rather larger than the end of the shaft, which is also made circular, and by a bolt at the lower end that enters a hole in its supporter; they are thus fixed in order that they may be moved round at the pleasure of the workmen, to enable them to bring all parts within their reach when standing on either side. For drying, the arms must be first covered, and then the floor, beginning at the top of the stove and proceeding to the ground floor.

There must be an apperture in the roof, where the steam can pass off; and herein consists the advantage of a circular building; the roof being conical, and the stove pipe passing through its centre, round which an opening is left, the steam naturally rises to that part, and passes off through the said opening. The roof should be covered with slate or pan-tile to make the whole perfectly secure against fire. This stove, if properly attended, will dry two hundred and forty pounds of wool every twelve hours, with a moderate consumption of fuel.

An air stove is made after the same manner as the drying room of a paper mill, only much narrower: it is to be filled with the same kind of apparatus for drying the wool as described for the fire stove.

The common mode of drying wool I need not describe, as every manufacturer is well acquainted with it.

It may appear to those who are ignorant of the business, that drying of wool is too simple an operation to need any comment, yet this is far from being the case. There are points to be observed in many of the most simple operations, which have an essential bearing on the interest of the whole, and one of these must be particularly attended to in wool drying, or the staple will be materially injured.

It has already been stated that wool will be injured by exposure to atmospheric air, after it has been scoured, but it will be injured much more rapidly by being exposed to the sun, or to the high temperature of a fire stove. It is necessary, therefore, to take it up, in either case, as soon as it is dry, and in the summer months when the atmosphere is clear, and the sun is powerful, it should be taken up before it is quite dry. It is at this season of the year that an air stove is useful. The wool is partially dried in the sun, and then removed to the air stove, where the drying is completed. Those who use air stoves entertain an opinion, that wool dried in this way, will spin better, and handle softer when in cloth, than when dried altogether in the sun.

In a fire stove, the heat is raised to and kept at a very high temperature until the wool is about three fourths dry, then it is permitted to cool gradually, until it approaches to about ninety degrees, at which heat the drying may be finished with safety. One hour's exposure to the sun in the summer, or to a similar heat in a stove, after the wool is dry, will sensibly injure the flexibility of its staple. It is necessary for the American manufacturer to pay particular attention to this during the summer months; for if the wool be injured by unnecessary exposure at that season in the mild climate of England, how much more must it be injured here, where the heat of the sun ranges from twenty to thirty degrees higher.

TWILLING THE WOOL.

WHEN wool is dried after scouring, or after colouring, it has to be passed through the twilly, to open the locks, and to seperate all the dust and other filth from it. Since my remembrance this was altogether performed by women, who beat it with rods, on hurdles made for the purpose, which separated the dust from the wool and opened the locks, and they afterwards picked out by hand all the lints, straws, or whatever larger filth might adhere to it. Some manufacturers have pursued this mode of working it to the present day, and assert they are no losers by it, imagining that the picking machines not only injures the staple by breaking it, but that it is nothing like so well cleaned. There are different kinds of machines for the opening and cleaning of wool, such as devils, twillies, and tuckers. It is of little consequence which is employed, so that the wool is well opened and made thoroughly clean.

OILING OF WOOL.

AFTER wool has been passed through the twilly, it has to be oiled, which operation is performed by first spreading a thin layer of wool on a clean floor, surrounded by boards to prevent its falling about, some oil is lightly spread over this first layer, either with the fingers, or a watering pot; another layer of wool is then spread over the first, which is oiled in its turn, and so on till the whole has been oiled. From two to three pounds of oil are in England spread over twenty pounds of wool: the latter quantity is rarely exceeded, excepting in some particular colours, in which acid mordants, or strong astringents, have been used. In this country it is customary to use a quart of oil to ten pounds of blue wool, and frequently a quart to eight pounds: why this should be necessary I cannot account, but I have often heard the spinners complain when only a quart to ten pounds has been used.

After wool has been oiled, it should be well mixed together, and let it lie in a heap for some hours to give time for the oil to spread itself through all parts equally, and to penetrate the pores of the wool. In warm weather the oil will be sufficiently liquid, in winter an artificial heat is necessary to liquify it, and at this season the operation of oiling should be performed in a warm room.

The benefit to be derived from this process will very much depend on the quality of the oil. In choosing it for this purpose three qualities are essentially necessary: clear and limpid, containing little or no mucilage, it must not possess any drying property and must be such as will easily form a sponaceous compound with the volatile alkali. Oil containing much mucilage, fills the machines with filth, soon clogs them up and retards the spinning and weaving; drying oils harden the wool, make it brittle and unfit for the subsequent operations; that oil which will not readily form a soap with the volatile alkali, can never be scoured out of the cloth after it is woven; it will form a clammy substance with the soap in fulling, which adheres so tenaciously to the fabric that nothing will separate it; and if it has to be coloured afterwards, the dye never can be permanently fixed upon it. It is certain, therefore, that animal fat of any kind, and nearly all the fish oils, together with some that are extracted from the seeds of vegetables, are totally unfit for this purpose. Neats foot oil is softening and will form a soap with urine; but it frequently contains too much mucilage to rely upon its use, particularly that which has been boiled from stale feet. Olive oil of that impure kind, which is sold under the name of Galipoli, possesses all the necessary qualifications, and is generally used in Europe for the purpose. This is imported in butts, pipes, &c. and in England is sold by the tun.

I have no doubt the olive could be raised in some parts of this country, and sufficient oil made to supply not only for home consumption, but also for exportation. I am informed that a company of French gentlemen have associated for the purpose of planting the olive.

There are also fruits and seeds from which a good oil may be extracted. The poppy seed affords an oil equally as good as the olive, and the produce, independently of the oil, is highly valuable, and brings great profit to the raiser. The sun-flower seed gives a fine oil. I once raised a few to try it, and had three quarts ex-pressed cold. It proved fine and sweet. I used it on full blooded merino wool, and it appeared to answer as well as the finest olive. I have heard others say, who had tried it, that it was too mucilagenous; but I am inclined to believe that what they used was either too hot pressed, or stamped in bags full of linseed, or rape seed oil, which would render any small quantity sufficiently impure to destroy its quality for this purpose. The sun-flower seed does not afford a great quantity of oil, it is said to be a dry seed; but as a compensation for this, the land produces a large quantity, and the cake is probably the best known feed for cattle, horses, or hogs. The nut of the beech, or what is called beech mast, is said to give an oil as good as the olive, and is used as a substitute for it in many parts of the European continent.

Doctor J. Morgan, in the transactions of the American philosophical society, has given an essay on the raising of the sun-flower, and the extracting of oil from its seed. These experiments were made at Bethlehem in Pennsylvania: his essay informs us, "that one acre will yield to the planter from forty to fifty bushels of seed, and that from each bushel can be extracted nearly one gallon of mild oil." When oil is intended to be used on wool, it will be necessary to give only a moderate degree of heat previous to pressing; for if it has too much, the oil will contain so great a portion of mucilage as to ruin it for this purpose.

When in England, three years since, I copied the following notice from a work then recently published. "It is reported, a person is going to take out a patent for making a small hand-mill, for every family to make their own sweet oil. This may easily be done, by grinding or beating the seeds of white poppies into a paste, then boil it in water, and skim off the oil as it rises: one

bushel of seed weighs fifty pounds, and produces two gallons of oil. The poppies will grow in any garden: it is the large head white poppy, sold by apothecaries. When the seed is taken out, the poppy head, when dried, is boiled to an extract, which is sold at two shillings per ounce, and is to be preferred to opium. Large fortunes may be acquired by the cultivation of poppies."

In the *Artists' Manuel*, by James Cutbush, Esq. there is much valuable information on this subject, under the head "oil." The following is so remarkable for its quality and great produce as to induce me to extract it; for if the seed can be obtained, and the farmers can be prevailed upon to raise it in any part of the United States, a supply might be obtained sufficient for this and other countries.

"*Bene, or Ben Seed Oil.*"

"On the subject of the ben seed oil, the following letter of Mr. John Morel to Mr. Charles Thompson, Secretary of the American Philosophical Society, at Philadelphia, dated Savannah, May 5th, 1769, may be useful."

"I send you a small keg of bene, or ben seed, which you will please to present to your society for their inspection. This seed makes oil equal in quality to Florence, and some say preferable. Some say one hundred weight of seed will produce ninety pounds of oil, others say less; be that as it will, it certainly makes very fine oil, and produces amazingly. If it is put to the trial, care should be taken to have the press well cleaned, so as to leave no tincture from what may have been already pressed. In my opinion this is an article of consequence, and I believe it will grow in Pennsylvania. The way to sow it is in holes about three feet asunder, dropping in each hole about ten grains; when it comes up, thin it to three or four of the most promising: the seeds will appear in pods, about September, and should, when full grown, and before dry, be gathered in. The method is as follows: as soon

as you perceive about three-fourths, or four-fifths of the pods rise on the stalks, and the lower pods begin to loosen their seeds, it is then time to take it in; for after that, as much as ripens one day at top, so much falls out of the pod at bottom. You take a sharp hatchet-bill, or some such weapon, and with it cut off the stalk from twelve to eighteen inches below any of the seed, holding the stock with the left hand, and when cut, a second person receives it, keeping it upright, till he has his load; for if you turn it downwards, the ripe seeds will fall out of the pods. You may immediately carry it into a barn, and set it upright on a close floor, till you perceive all the pods fully dry and open, then thresh it, and run it through a proper seive, and it is fit for use."

At the time this seed was sent to the society, the consumption of oil in America was an object of little consequence; the case is now altered: there are woollen factories in operation that are consuming seventy pounds of oil daily, and others are beginning to work that will use from ninety to one hundred pounds. If this great and daily increasing demand have to be supplied from foreign countries, it will be adding no small item to those imports which are already much too great for the welfare of the country.

MIXING OF COLOURED WOOL AND WHITE FOR MAKING MIXTURES.

ONE-TENTH part of white makes a good common mixture with any coloured wool; it often happens, however, that either very light, or very dark mixtures, are fashionable. When one or more of white wool is mixed with ten of coloured, it is only necessary to throw them in alternate layers, as even as possible, and then pick before oiling; but when only an eye of white is mixed with coloured wool, it requires more attention to obtain a regular mixture. If from one to two pounds of white are required to be mixed with seventy or more of coloured, proceed as

follows: first mix the white with ten pounds of the coloured: pass this through the picker, then mix this with what remains of the coloured, and pass the whole through the picker a second time—then oil it and pass through the picker again: let it be now scribled and run through the picker, when it will be completely mixed and fit for carding.

My receipts give directions that nine pounds fourteen ounces of oil should be used with seventy-four pounds of black wool, having ten ounces of white in it; in this country it is common to use nine quarts of oil on the same quantity which weighs sixteen pounds. I cannot account for this any other way than by supposing that the wool is not so well worked down in the breakers.

SCRIBLING AND CARDING.

THE main cylinder of a scribler is called by workmen the fixture, although it moves with greater velocity than any other, excepting the fancy. In most machines four cylinders, called workers, are placed round the top of that part of the main which is above the frame; to each of these is attached a small cylinder for the purpose of clearing the wool from the workers, and carrying it back to the main cylinder. The points of the workers, when in motion, meet the points of the main, and are set some distance from it. The points of the clearers move the same way as those of the main, and are to be set as close to it, and to the workers, as they can be, without coming in contact, and the breast roller the same; these clearers must move with much greater velocity than the workers. The breast-roller, or licker-in, takes the wool from the feeding roller, and delivers it to the main cylinder; then takes it again from the first worker, and delivers it to the main a second time. The two largest cylinders next to the main, are called the fancy and doffer, their use is to raise the wool upon the main, and to deliver it when finished by the workers. The

fancy roller raises the wool upon the main high enough for the doffer to take it off; it should move with a velocity greater than the main, by one inch in twelve; the points move in the same direction as the main, and are the only ones that comes in contact with it. The doffer has a slow motion, and its points move in a direction to meet those of the main, and a comb takes the wool off the doffer. A carding machine is made every way the same as a scribler, excepting that the doffer is clothed with sheet cards sufficiently wide to collect wool enough for one roll, and a space left between the cards, so as to prevent the wool from interfering one with another. As the wool is cleared off each card, by the comb, it falls under a fluted roller by which it is formed into rolls.

There are many trifling variations in making these machines, which it will be useless for me to describe, as they are now generally well understood in this country. For the same reason, I should have considered it unnecessary to have given any description of the scribler, nor should I have done so, with any other view, than to elucidate those observations that will subsequently be made.

The workman who manages the scribling and carding machines, must take especial care that the wool be properly prepared, by being well opened in the twilly; for should it be lumpy, the workers will have to be placed too near the main cylinder, by which the wool will be forced so far into the wires as to prevent the fancy from raising it up; of course it will pass round a second time, and the main will become so clogged as to injure the working. It is on this account, that some English manufacturers continue to have their wool beat and picked by hand, as mentioned under the head picking: they consider that the extra expense incurred by this mode of working, is compensated for, by the wool being made cleaner and more open, and by the consequent durability of the cards. The best machines for opening the wool should be employed, and this expense need not be incurred. The common tucker generally used in this country, does not open the wool sufficiently

for fine work, it divides it into much smaller lumps it is true, but the hairs of the wool are not well opened by it. The English twilly, having fans as well as teeth, is the best machine for this purpose; and any manufacturer, desirous of having one, need only apply to Mr. Charles Neal, machine maker, at Hartford, Connecticut. This gentleman was connected, for fourteen years, with one of the best machine makers in the west of England, and those who employ him will have their machines made in great perfection, and the work performed very faithfully.

The licker-in must be so placed, as to take all the wool from the feeding rollers, and deliver it to the main cylinder. The machine must be fed even and regular. The working cylinders must not be placed too near the main, yet near enough to work down the wool as much as it will bear. For carding of fine, they are to be placed considerably nearer than when set for coarse work, and the distance must be regulated by the quality. The doffer must be as close to the main as it can be, without coming in contact, for should it fail to take off all the wool, what passes round a second time, will be nippy, and an unusual quantity of flock will be found under the machine. It scarcely need be mentioned, that every cylinder should be exactly parallel with the main, and that the fancy and doffer are of more consequence in this respect, than any of the others.

When a new carder, or scribler is made, or old ones are newly covered, it should be done with cards, number thirty-three, for fine work, and with number thirty-two for middling qualities. The cards are filled with flocks, excepting those on the fancy, to a little below the bends of the wire: with white shear flocks for white work, and with coloured for coloured work. The perfection of the workmanship depends on its being free from lumps and nips, and the hairs of the wool regularly separated from each other, without the staple being broken. The rolls when held up, between the person examining it and the light, should appear perfectly clear, and of the same size and substance the whole length,

excepting a diminution at the tips, as far as they join, so that when two are rubbed together, they may as nearly as possible, be the size of one. It is also necessary that every roll be of the same size, and contain exactly the same quantity of wool, which they will be if the doffer cards are all of the same breadth, and the machine is fed regular.

THE SLUBBER.

THIS machine should contain forty spindles. The sheets placed on the rollers, are moved by a string attached to a mouse under the carriage, to which string hangs a small weight. When the yarn is intended to be fine, the mouse is placed nearer the spindles, and farther from them when intended to be coarser. The spindles should be made and set so that the band may move them all equally, and with a light motion. When a billy has too much twist, it is difficult to draw out, and when too little, the thread in some places will be large, and in others small, being what is called gouty: an equal thread is the criterion of perfect work. It will occasionally happen, in drawing out, that one or two threads only will be gouty. In that case they must be taken off by the slubber and thrown into the waste basket. When it is intended for the yarn to be fine, the slubbing also must be fine, and *vice versa*. The twist for warp and filling should be different, when one is twisted with an open band, the other should be done with a cross band.

SPINNING.

A JENNY ought never to contain less than seventy spindles, and is still better with eighty. The principal operation in spinning, consists in taking up and twisting. When the slide is drawn

out a sufficient distance to take up the clove, the twist of the jenny must first undo that which was given by the billy in slubbing, and give to it a little additional twist before it be drawn any farther out; the clove is then taken up, and the slide is gradually drawn to the extremity of the machine, the workman continuing the twist as he draws it out. If too much twist be given to it, either before closing the clove, or in drawing out afterwards, the work will be so bound, that the slide will not slip; if two little twist be given, it will draw into gouty threads, thin in places, and uneven all along. When drawn out, if it be intended for fine yarn for warp, it must have twenty-five turns of the large wheel. The faller must now rest on the threads, and the yarn be twisted the contrary way, till that which before rested on the points of the spindles, return on the cops; while the slide is returning, the twist must be given as at first. For fine work, the clove must be taken up short, for coarse, longer, and the latter must also have less twist.

I have given directions, in twisting for warp, that it should have, after drawing out, twenty-five turns of the large wheel; but as scarcely any two jennies are calculated to give exactly the same twist by the same number of turns, no directions can be followed literally, and the twisting must be governed by the judgment of the boss, or workman.

Before we proceed, it will be necessary to explain how yarn is calculated, and this will be attended with some difficulty, as the way of doing it varies in different counties in England, and with different manufacturers in the same county. In many parts they calculate by the skein, reckoning so many to the pound. I shall give an account of the mode of calculating generally pursued in Gloucestershire, which is by the run, and when it is understood that a run of yarn is sixteen hundred yards, there will be no difficulty in reducing any other mode of calculating to this standard. Yarn is spun from two to ten run to the pound, according to the quality of the wool and to the purpose to which it is intended to be ap-

plied. I have never known it spun more than six run for broad felt cloth, and ten for single cassimere; and none but the finest Saxony wool can be drawn to ten run. Nothing can be more injurious to the interest of the manufacturer than the attempt to draw wool too fine, or beyond its staple, and it is much better to keep within the line than to go beyond it. There appears to be a mania among the clothiers of the present day, to make very fine spinning, and although this has been pursued beyond its maximum, yet every one knows that the cloth now made, is neither better looking, nor any thing like so durable, as when the yarn was not spun so fine. There is a medium to be observed in this, as there is in every thing else, and those who deviate much on either side will be injured instead of being benefitted. In spinning yarn, that medium lies in having it drawn just so fine as to draw and twist easily and readily in the jenny, without much breakage; for when chain yarn is spun too fine, beyond the staple of the wool, it will break too much in spinning; will be difficult to weave, and will not wear well when made into garments. It is essentially requisite that the manager of a woollen factory, when he receives a lot of wool, should know by its quality how fine it ought to be spun, and what description of cloth can best be made from it; for unless he knows this, he must be deficient in judgment, in one of the most important points of a manager, and the manufactory that is under so ignorant a director, can never be expected to flourish.

The yarn for filling, when intended for broadcloth, or narrow, if plain wove, will have to be spun different from the chain. The yarn I have before described is for chain, that for filling must be spun with a twist the reverse of this: it must not be twisted so hard and somewhat coarser: when the yarn for chain, is six run, or nine thousand six hundred yards to the pound, the yarn for filling should be five run, or eight thousand yards, a few yards less being of no consequence, provided it exceeds not four hundred, or a quarter of a run. In all cases the yarn, whether for chain or filling, for one piece, should be spun exactly alike. Chain yarn is called the

warp, and the filling the abb. Single cassimere is filled with yarn, spun of the same size, and with nearly as much twist as for the warp. Broadcloths are sometimes kersey-wove and are then called rattinnets; the manner of making these, and of milled cassimeres will be hereafter described.

When the spinners begin any given lot of wool, a run, or some part of one, either half, quarter, or an eight, should be snapped and weighed, in order to ascertain its fineness; this is done to enable the manager to regulate the warping, and to ascertain what quality of filling it may want. All the warp of one piece of cloth should be the work of one jenny, and the filling be that from another; for if the work of two spinners be mixed, either in the warp, or in the filling, the cloth will be rowy, and baggy, a defect not much noticed in this market, although in England it depreciates the value of the goods from ten to fifty per cent. This defect may appear in cloth, when yarn is spun on the same jenny. If the pullies that work the spindles are not exactly of the same size, or the bands working round the pullies to move the spindles, should any of them be so loose as to slip while in motion, the thread from those spindles having the longest pullies, or where the bands slip, will have less twist in them than others. When this happens in spinning of warp, the cloth will be warp rowy, and when in spinning of abb, it will be abb rowy; the one being rowy in the length, and the other in the breadth of the cloth. The same effect is produced when the work of two spinners happen to get mixed, either in the warp, or filling. This is a common defect in American cloth and ought to be particularly attended to

A napping machine of two yards circumference, is a necessary appendage to every woollen factory. It should snap at forty bouts; five snaps making a quarter run of yarn. The yarn is calculated from this, which must be done accurately, or the whole system will be in confusion, as will be seen hereafter.

In many English manufactories the spinning is calculated by

skeins, and workmen who come from thence, will some talk of runs, and some of skeins, without knowing the length of either, as none but managers are in that country entrusted with this essential part of the business. I was much surprised the other day, in conversation with a person who now resides in New-York, and was some years since, first a weaver and then a master manufacturer in England, to find that he did not know the length of either a skein, or a run of yarn, and he was too communicative on other parts of the business to suspect that he had any design in withholding the intelligence. Eight score bouts, on a reel of six feet circumference, constitutes a skein of yarn; therefore, it is three hundred and twenty yards, and consequently five skeins make a run.

A machine has been invented by a Mr. Brewster, for spinning by mechanical motion; I have seen very good work done on it, but it is said to be too expenive, both in the first purchase and in the subsequent repairs. It would appear to be a very desirable object to spin on a machine, where the twist, when once fixed for any given kind of work, would always be the same. When yarn is entrusted to a spinner to be worked by hand, he must be very attentive, or some drafts of yarn will have a greater twist than others, as half a turn of the large wheel would make two per cent. difference in the twist of fine warp.

I was at a factory, not long since, in New-Jersey, where they calculated yarn by the bier, a mode of doing it, I believe, peculiar to those managers. They boasted highly of the secret, which they informed me, was obtained from an old countryman, who they said was the only person they had ever met with that knew any thing of calculating yarn. I am aware, as before stated, that very few working Englishmen know any thing of this part of the business; and this I am certain of, that so preposterous a mode of doing it, must have been introduced by the person giving the information, or he must have picked it up from some one in this country, who knew nothing of English calculations. A run of yarn, as before mentioned, is sixteen hundred yards; a skein is three hundred and

twenty, or one fifth of a run. A bier is twice nineteen, twice twenty, or twice twenty-one threads, of an indefinite length; the run and skein are the different ways of calculating spinning: the bier for the warping, and the blending of the two, proves that the person giving such directions, was ignorant of what he was doing: it was literally the blind leading the blind.

One of the managers was so obliging as to give me a list of this mode of calculating; but it was some time before I could obtain any certain account of the length of yarn in a bier, the manager who gave the list, appearing to know nothing about it, and the boss weaver was the only person from whom I could gain this necessary piece of information. I need only give an account of their plan, to show its absurdity, and to prove its relative disadvantage over the system I have before described.

They suppose two thousand six hundred yards to be a bier of yarn, and from this number they make their calculations. It is of little consequence from what number of yards yarn is calculated, provided that number can be reduced by geometrical progression, by the ratio two, to a small number of yards without producing a fractional part of two yards. When the number assumed will not admit of this, it makes the calculation complicated and troublesome. Taking a run, or sixteen hundred yards, as the standard, it can be reduced to fifty, without a fraction; but when two thousand six hundred is the assumed number, it cannot be reduced below six hundred and fifty; without one, therefore, the calculation by the run, must be as the quotient of six hundred and fifty, divided by fifty, or thirteen times better.

Two bier yarn, are three and a quarter run.

Two and a quarter bier, are three and five-eighths and fifty yards.

Two and a half bier, are four run and one hundred and fifty yards.

Two and three-quarters, are four run and three-eighths and one hundred and fifty yards.

Three bier yarn are four run and seven-eighths.

Three and a quarter bier, are five run and a quarter and fifty yards.

	Cts.		Cts.		Yds.
For spinning two bier yarn, they give	5½	per bier, or	11	for	5200
two and a quarter, .	6	. . .	13½	for	5850
two and a half, .	6½	. . .	16¼	for	6500
two and three-quarters,	7	. . .	19¼	for	7150
three, ...	7½	. . .	22½	for	7800
three and a quarter, .	8	. . .	26	for	8450

This is the highest bier they go to, leaving off at about five run and a quarter. For spinning of filling for broadcloth, they give from four to six cents per pound

I have made this digression to show the absurdity of their mode of calculating, having discovered that several respectable manufacturers were induced to believe, from the boasting of the parties, that they were in possession of some important and highly valuable secret, and it being necessary in the infancy of a manufactory, that the most simple and least complicated plans should be adopted.

WARPING.

THE chain is calculated by biers and hundreds, one hundred being five bier. The bier varies. In some places it is reckoned from nineteen threads, in some from twenty, and in others from twenty-one. A chain is warped in two sides, and taking nineteen

threads as the standard, each hundred will be twice five times nineteen threads, or ninety-five threads. Supposing I want a warper to warp a chain of seventeen hundred, I should give orders to have it warped eighty-five bier, or sixteen hundred and fifteen threads; and as a chain is warped in two sides, each one containing that number, it will necessarily be double the quantity, or three thousand two hundred and thirty threads. Taking seventeen hundred as a data, by which to calculate, it will be easy for any manufacturer to make an estimate of any other given hundred, or bier. It being, however, necessary to know how to regulate the spinning to the hundred, and this to the width on the loom, I have, for the accommodation of the trade, drawn out a table as follows:

Run of yarn.	*Bier to warp.*	*Width on the loom.*
6	90	12 1-2 quarters.
5 1-2	87	12 do.
5	82	11 1-2 do.
4 1-2	78	11 2 nail.
4	70	11 do.
3 1-2	65	10 3 do.
3	62	10 1 do.

Ninety bier, or eighteen hundred, are sometimes set thirteen quarters, and the others in proportion; and it is always better not to crowd the chain too much on the loom, as it prevents the weaver from putting in a proper quantity of filling. It will now be clearly seen why the manager must accurately ascertain the length of chain yarn in a pound, as it comes from the spinner; for unless this be correctly done, he can have no data by which to regulate the warping, or to direct what filling may be wanted for it. He should reel five snaps on the snapping machine, described under the last article, which will be four hundred yards, or a quarter run, and having weighed it, must calculate how many yards there is in a pound, and then reduce them into runs by dividing by sixteen hundred, and multiplying these by five, will give him the number of skeins. Or he may divide the number of yards in a pound, by three hundred and twenty, which will give the skeins, then by

five, and the quotient will be runs. The calculation may also be made in a more direct and less complicated manner. Supposing the four hundred yards when weighed, should be exactly four ounces, it will be one run to the pound; if two ounces, two run; if one ounce, four run; and, if half an ounce, eight run. So far it would be very easy to make a calculation, but not so when the last quantity should weigh half an ounce and three or four grains, or any other odd number. It is better, therefore, for every manager to make out a table by which to calculate, having previously fixed upon some geometrical portion of a run for the snap of the reel, and having divided a quarter pound weight into geometrical parts. In order to make this system as clear as possible, I will give a specimen of the table referred to. We will take a quarter pound as the standard weight, and the snapped yarn at four hundred yards. The weight will have first to be divided as follows:

Into one half of a quarter.
one quarter of do.
one-eighth of do.
one-sixteenth of do.
one thirty-second of do.
one sixty-fourth of do.
one, one hundred and twenty-eighth of a quarter
one, two hundred and fifty-sixths of a do.
one, five hundred and twelfth of a do.

There will then be only nine weights necessary to weigh every quality of yarn, and all we now have to do, is to ascertain what proportion each of these weights will be to a run of yarn. Let the weights be numbered, beginning with the largest, from one to nine, then apply the following table:

No. 1 is the half of one run, or two run to the pound.
2 is the quarter of one run, or four run to do.
3 is the eighth of one run, or eight run to do.
4 is the sixteenth of one run, or sixteen run to do.

No. 5 is the thirty-second of one run, or thirty-two run to the pound.
6 is the sixty-fourth of one run.
7 is the one hundred and twenty-eighth.
8 is the two hundred and fifty-sixth.
9 is the five hundred and twelfth.

If the yarn should weigh number three, it will be eight run to the pound; if it weighs number three and four, it will be eight run less, one half, or four run to the pound; if it weighs number three and number five, it will be eight run less one quarter, or six run to the pound; if it weighs number three and number six, it will be eight run less one-eighth, or seven run to the pound; if it weighs number three and number seven, it will be eight run, less one sixteenth, or seven and a half run to the pound, and so on through the whole series.

It will readily be perceived that by this regulation, the manufacturer need only weigh the yarn, and by referring to the table, he will be able, after a little practice, to calculate without figures, by merely setting down the proportions as there stated.

The filling for broadcloth should have just as much, and no more twist, than will enable it to draw off the bobbins, and follow the shuttle, without much breakage. It must not only be looser spun, but it must also be coarser than the warp. When a chain is made from spinning of six run to the pound, the filling should not exceed five, and is still better when only four run and three quarters.

The manufacturers of the west of England have varied in their mode of making, twice since my remembrance, and in order to obtain the newest mode, I wrote last fall to a clothier in Gloucestershire to inquire how they were at this time making their broadcloth and cassimere. The result of that inquiry I shall proceed to lay down:

"A thirty-six ell (fifty-four yards) chain is warped eighty-four bier, is set on the loom eleven and a half quarters, is fulled into six and a half quarters *in cloth*, when raised and tentered, will be fair seven quarters, and if well wove, will measure forty-two yards. The chain should weigh twenty-two pounds, and should have put into it fifty pounds of filling. The warp should snap twenty-six, and the filling twenty skeins to the pound.

"The mode of making cassimeres has greatly varied; but the best makers, are warping them, both double and single, twelve hundred, or sixty bier, the double are warped thirty-four ells, (fifty-one yards,) are set on the loom twenty-one nails, and fulled into thirteen. The warp and the filling should both snap twenty-eight skeins to the pound, the chain should weigh fourteen pounds, and if well wove, will take full twenty-five pounds of filling. It should measure, when finished, forty-two yards.

"A single cassimere chain of thirty ells (forty-five yards) should weigh about eleven pounds, and if well wove, will take from sixteen to seventeen pounds of filling. It is set on the loom seventeen nails and fulled into twelve and a half. The warp should snap thirty-six, and the filling, thirty-eight skeins to the pound, and should measure, when finished, forty-four yards."

I wish to be very particular in describing this part of the business, as it belongs solely to the managers, and unless well understood by them, they never can expect to make cloth regularly good, or with any prospect of success. I shall endeavour to give such directions as cannot be misunderstood, and to make such calculations as will enable those who are totally ignorant of the business, to understand it. The regulations in spinning, warping, and weaving, may be said to be the *primum mobile* of manufacturing; for should every other part be executed in the most masterly manner, and these, either from ignorance, or neglect, be imperfect, the fabric produced can never be good; and if a piece now and then

should prove superior to the general run, it will be owing more to chance than to design. It behoves the manufacturer, therefore, to pay particular and personal attention to these branches of the business.

When a chain is warped twenty-one threads to the half bier, instead of nineteen, as I have directed, it must be set wider on the loom, or the bier must be lowered. To enable manufacturers to understand why this is necessary, I will make a calculation to show the difference between the two. A chain of spinning that is six run to the pound, is directed to be warped ninety bier of twice nineteen threads, and will contain three thousand four hundred and twenty threads, but when warped twenty-one threads to the half bier, a chain of ninety bier will have in it three thousand seven hundred and eighty threads; which is three hundred and sixty more than the other, or nearly ten bier of twice nineteen threads additional; and if this be set in the loom the same breadth as the other, it will be so crowded as to prevent the weaver from putting in a proper quantity of filling. It is a common failing in American made cloth, that it is deficient in filling, and too crowded in the warp.

This calculation proves how necessary it is when biers are spoken of, that the managers should know what number of threads were warped to make it; for unless this be understood, they will have to work in the dark. That the system of regulating work may be rendered clear and easy to the comprehension of every one who may feel an interest in it, either as readers or manufacturers, I shall add a table that will, at one view, present to them the whole subject with all the necessary calculations.

In the first column of the table is given the quality of the yarn, beginning for broadcloth at six, run, and proceeding to three run—the second gives the number of skeins contained in the runs, the third the length of thread, the fourth the hundred which it should be warped, according to the run, and the fifth the bier

contained in those hundreds—the sixth the number of threads contained in the bier when warped nineteen to the half bier, the seventh and eighth the number of threads when warped twenty and twenty-one, the ninth and tenth the extra number of biers contained when warped twenty and twenty-one. The four last named columns are designed to show the manufacturer that when chains are warped twenty and twenty-one, the number of biers must be lowered so as to bring the work to the standard I have marked out; and in the columns twelve and thirteen the proper width for setting cloth on the loom, according to the run of the yarn. The fourteenth column gives the run of the filling for each quality of warp, and the fifteenth gives the length of the warp. Then follows first the weight of filling which that length ought to have beat into it in the loom, the next the length of cloth when finished, and then the breadth when fulled and when finished.

I am aware from what little I have seen of American manufacturers that it will be difficult to prevail upon the workmen to perform their weaving agreeably to the plan I have laid down; but the owners of factories may rely upon it that the nearer they can bring their work to this standard, the more nearly will their cloth resemble that which is imported from the west of England. It will be perceived that when broadcloth is warped from five run yarn, it should be eighty-four bier, and have about fifteen ounces of filling to each yard upon the length warped; but fifteen ounces of American filling will not make so stout a cloth as the same quantity of English filling will do—this may appear paradoxical at first sight, but not so when explained. Fifty pounds of American blue wool will have put on it five quarts of oil, weighing about nine pounds, while the same quantity of wool in England will have barely six pounds; therefore, when a weaver in this country puts in fifty pounds of filling, the cloth will have in it three pounds less of wool than when the same weight is put in, in that country, which will make a difference of nearly one ounce upon each yard, bar length.

SIZING THE CHAIN

IS performed in a liquor prepared by boiling limed pieces, glue, or skins of animals, in water till reduced to a jelly. The chain is moistened in a weak solution of this liquor, being passed gradually through it while it is warm, in a large washing tub. When a few yards have been soaked, and wrung out, another length is put in, and so on, till the whole has undergone the operation. The chain is shaken as it is wrung out, either by the person sizing it, or by another employed for the purpose; the shaking has for its object, to prevent the threads from adhering together, which they would do from the adhesive quality of the glue, if the chain were permitted to lie many minutes without it.

The sizing liquor should be strong enough to give to the yarn when dry, a moderate degree of hardness, yet not too stiff. The chain being warped in two sides, each one is sized separately, and when this has been performed, they are taken to a favourable situation, stretched and dried. In some factories, this is done by hand, in others, by a machine so made as to place cross-bars alternately under and over the chain, by which any stretch or pressure can be given that may be wanted. When a chain is placed on this machine, it lays at first on the bars that are intended to remain underneath it, being every other one, and moderately strained over them; the first, or head bar, is put through the loops of one end, and the other end is fastened by pieces of thrum to the bar at the other extreme of the length of the chain. A wrave is placed on the chain before it receives any strain, and passed from the head to the last end, where it remains. The wrave should have as many pins in it as there are half biers, that half a bier may pass through each space. When this has been done, the cross pieces that go over the chain are put on, the necessary strain given, and the piece left to dry.

A chain should be dried when the atmosphere is dry and clear,

and the sun not too powerful; for should the day be close, or what is vulgarly called murky, and the sun shining very warm, the glue is apt to run, and leave the chain so supple, that it will not weave. When wool dyed warps, or mixture are to be sized, a little whiting is often used in the liquor to strengthen the yarn; but this must never be used in white work, because it is difficult to wash out afterwards, and should any remain in the cloth, the dye would be injured.

WEAVING.

LOOMS are differently made. The odd fashioned loom has the chain beam placed on a level with the reed, on which the chain is wound from the wrave. In the modern loom the chain beam is placed below, and the chain passes over a bar at the back. The latter has this advantage over the former, that the chain is always in one direction with respect to the reed and the work, and a regular strain is more equally preserved. The slay, or reed has to be made to suit the work wanted, and the harness adapted to both. In some factories, they have the cloth woven three, and in others four threads through each split of the reed; but this is never done by those who undertand the best mode of working: they never have more than two threads in a split. The reeds for the latter, are more expensive, but they are more durable, and the threads of the warp are not so much chafed during the working. Every yard of broadcloth should have from fourteen to fifteen ounces of filling woven into it, warped length. It will be unnecessary to instruct, in this place, what description of filling is necessary for any given quality of chain, as by referring to the table under the head warping, the whole can be seen at one view.

Good workmanship in weaving, is of more importance than in any other branch of the manufactory, and unless this be well executed, good cloth can never be made. A first rate weaver may

make bad yarn into good cloth, but when the fabric is badly put together in the loom, all previous workmanship, however good, and all subsequent labour bestowed upon it, however ably done, can never turn out a good article. I shall endeavour to give such instructions as will enable manufacturers to understand what has to be done to make good weaving: yet after all that can be said, or written on the subject, nothing but experience can make them critically acquainted with it; and so long as managers are content to leave this and other important branches to the direction of under bosses, so long will their concerns go on imperfectly. The master manufacturers in England, never leave the direction, or inspection, of any important part to hirelings, for they know full well that one hireling will colleague with others of the same class, although he may be placed a little above them. The master, who is ever the owner of the factory, gives directions what has to be done, and he personally inspects the work, to see that it is executed agreeably to his instructions.

To have good weaving, the warp must be kept tight on the loom, and the filling put in with an even beat; that is, there must be the same number of threads in one inch of the cloth as there is in another. When cloth is woven with a loose chain, a sufficient quantity of filling cannot be put into it, and when fulled and finished, it will be then in texture, and feel hollow and spongy—when it is unequally filled, and thin in places, it will be baggy when finished, owing to its fulling in faster in the places that have been woven thin, than in others, where more abb has been beaten in. When two small a quantity of filling is put in, and yet wove even, the cloth will full very rapidly in length, so that the manufacturer will have to pay from five to ten per cent more for bad weaving, than for good. It often happens with indifferent weavers, that they will weave one side of the cloth tighter than the other, this may be occasioned by the beaming being irregular, having been strained whilst winding on, more on one side than on the other, or it may occur also by the weaver's irregularity in working. When this occurs, the cloth will be what is vulgarly called lop-sided, and

in dressing, or raising the nap, that side which has had the greatest strain, will be cut against the list, and have a good nap raised on it before the other is more than two-thirds raised.

The yarn for filling is usually wound on bobbins that are put into the suhttles and thrown across the warp. This in some factories, is done on the jenny spindles as it is spun. In common, however, it is wound off the jenny cops by girls, each one winding for three or four looms, and it not unfrequently happens, that by mistake, or carelesness, the bobbins will get mixed, or those intended for one cloth will be taken by the weaver of another; in this way two kinds of spinning become mixed in the same piece, when such cloth will be what is called rowy, that is, the filling of one kind of spinning fulling in faster than the other, will leave the cloth in some places tight, and in others loose and wrinkly. This is a common defect in American made cloth, and is often seen in that which is imported; for in England such goods will not sell unless at a considerable reduction in price, and they are sent to this market because such damage has not yet been noticed here. That which is badly rowed is not considered there to be worth more than half as much as that which is perfect; and a single row in a whole piece depreciates its value. This defect might be easily avoided by having the bobbins filled on the jenny; but when one girl has to wind for three or four looms, it cannot be so easily remedied, unless they could be made steady and circumspect, which I believe no wise man will willingly undertake to do. If the plan of putting out chains to weavers to be woven at their own houses, were adopted in this country, such defect would happen but very seldom, as the weavers would then be made answerable for all avoidable damage.

In many factories in England, the yarn is reeled into skeins, and these are made wet before they are wound into bobbins; in others, where the bobbins are wound from the jenny cops, they are wetted by means of a tin suction tube; for in weaving of all kinds

of woollen cloth, it is absolutely requisite to fill with wet bobbins. They are wetted with a mixture of water and urine, or water and soap. When cloth is woven with dry bobbins, a sufficient quantity of filling cannot be beat into it, owing to the elasticity of the wool, and the cloth will be thin and spongy ; when dry bobbins are occasionally woven in by carelesness, or mistake, the cloth will be rowy, the same as when different filling has been shot in ; and if a bobbin be not wet through, the outside being wet and the inside dry, the cloth will also be rowy, but in much narrower stripes than before.

When a cloth is begun by the weaver, he should in warm weather take off the work from the nether beam, or that beam on which the cloth is rolled when woven, at least every other night, and hang it up on the loom to dry ; for as it is woven with wet bobbins, and is not dry when wound on the beam, that part which lies against it, unless opened as directed, is apt to mould, and will appear mill-dewed, having yellow and blue spots in it, and is not unfrequently decayed in those spots.

A cloth from the loom is called a say, or flannel, and when the weaver has taken off a cut, it is the duty of the manager, which he should never neglect, to give it a close and critical inspection, to ascertain if the weaver has done his duty, and to fine him if he has been negligent and careless. I would reccommend that an additional price be given for every piece that is perfectly woven, and to deduct from the usual charge for every glaring defect. By these means good workmen would be encouraged. But when they find that bad weaving is paid for at the same rate as good, it operates as an inducement for those who know and can do better, to make inferior workmanship.

To enable a manager to inspect a cloth properly, he must be provided with a double perch, placed before a wide and deep window, on the north side of some room in the factory, for at no other light can defects be so easily seen. A perch is made with two

cross-bars suspended from the ceiling, placed from six to seven feet above the floor of the room, and parallel with the window. The front bar is two feet from the light, so as to enable the inspector to stand between the window and the cloth, the second is placed three feet behind the other; they are made rounding on the top, and are fixtures. The cloth to be examined is placed on the floor a little behind the last bar, and the head end is taken by the manager and the weaver, and is by them thrown first over the hind bar, and then over the front one. It has now to be drawn slowly over the perch, the persons inspecting it, standing between the two bars where they can thorough-light the cloth and see every defect, if they are previously acquainted with what are defects, which it will be my next object to describe.

Defective weaving consists first in the cloth being woven unequally, or some parts being beaten up closer than others; the thin places will show at the perch, and should be marked by those who are inexperienced inspectors, and the effect examined when finished—a single white thread tied in the list will mark them. Secondly, when different filling is shot into the same cloth, or when dry, or partly dry bobbins are thrown in, the former will not be visible if the filling should be of the same size and colour, but dry bobbins are readily seen, as the cloth will there be more open, and show more day light through it. Thirdly, having two threads in one place, or what is called double threads, which may be either in the whole breadth, or only part of it. When a double thread crosses the cloth, it is occasioned by the weaver throwing the shuttle twice, without changing the position of the harness, and, when only part of the way, it arises from carelesness in replacing the shuttle when the abb breaks, or when a new bobbin is put in. Fourthly, when the abb is thrown outside of some of the threads, owing to the chain not having been opened in every part before the shuttle crosses it. Fifthly, when the chain threads break and the weaving goes on without mending. Sixthly, when one side of the chain has had a greater strain on it than the other, which will make one list tight and the other loose: this defect mostly occurs,

as before observed, from the chain having been unequally beamed; it may also be occasioned by carelessness, or from want of judgment in the weaver.

Independently of these defects in weaving, cloth and cassimere may sometimes be pin-rowy, that is, when one thread is larger than another. This defect does not properly belong to the weaver, it being more the fault of the spinner, who has neglected to throw out the gouty threads, and of the bobbin winder, whose province it is, when gouts are left by the spinner, to break them off instead of winding them on the cops. Cloth that is pin-rowy, is only fit for black, as no other colour will hide it.

Single and double milled cassimeres are woven in narrow looms. They are worked with four treadles, four leaves of harness, and eight shafts; four above and four below; the whole depends on the rigging of the shafts, a process with which I am not sufficiently acquainted, to describe. All cassimere looms have the same number of treadles, leaves of harness, and shafts. The filling for single cassimere, is twisted the same way, and somewhat finer than the chain yarn, and the whole being made by the filling, will show fine in proportion to its fineness and twist. Milled cassimeres are filled with abb, spun the same as for broadcloth, only finer and more hardly twisted. Those broadcloths having a cassimere twill, called rattinets, are filled with yarn, such as has been described for double-milled cassimeres, and the rigging of the loom is the same.

I have already mentioned that, in England, weaving is put out to master-workmen, who perform the work at their own houses, and I have recommended the same plan to be adopted in this country, for reasons there stated. If our manufacturers should approve of this mode, and give into it, they must be apprised of one circumstance resulting from it, that they are liable to lose their stock by the weavers appropriating some of the yarn to their own use, and either selling, or making cloth from it. This evil, however,

may be easily avoided by adopting proper regulations, and keeping a vigilant look out after them. A weaver's book must be kept, in which the weight of the chain, before and after sizing, and the bier, are entered in different columns. A fourth column is appropriated for the weight of the abb taken out by the weaver to fill the piece. When the cloth is brought home, the waste is returned with it; the flannels being dried, is weighed after perching, and the weight with the waste added to it, is entered in a fifth column. After the flannel has been scoured and dried, and before burling, it is weighed again, deducting from the first weighing for the oil used on the wool, for the waste returned, and for the sizing, and allowing one-eighth per cent. for dust and dirt; and if the two weighings agree together, and these with the quantity of chain and filling taken out, no fraud can have been committed that is worth mentioning—the first weighing, compared with the stuff taken out, will not be an effectual check, as the weaver can size the yarn after taking it out, or he can do it even when in cloth; or if this be not done, the soap, &c. used in wetting the bobbins, will add to the weight. A weaver that is inclined, can add three pounds to every warp taken out, which he can appropriate to his own use, unless the manufacturer keeps the check upon him before described.

I have before mentioned, that weaving is not done by the yard in England. The chain is warped and calculated by the ell of one yard and a half. For each ell, the weaver is paid from one shilling to eighteen pence, according to the quality of the wool, the run of the yarn, and the substance of the cloth. One shilling is twentwo cents, and eighteen pence are thirty-three cents. In this country a weaver is paid as much for a yard as he is there for an ell, therefore, he has fifty per cent more here than there. Single cassimeres are woven there for eight pence, half mills for ten pence, and double mills for one shilling per yard. Eight pence are about fifteen cents, ten pence about eighteen cents and a half, and one shilling is a fraction more than twenty-two cents. I consider it useful to give this statement, because I know from experience, that American manufacturers never can get

at the truth from English workmen, and I have given those prices most favourable to the weaver. Many of the English master weavers make a property by their business, and surely they ought to do much better here, where they receive fifty per cent more for their work, and the difference in the price is not all the advantage they have, for in England, the weaver finds his own looms, harness, and reeds; and here they are found for them, which makes full 12 per cent more in their favour.

The American manufacturers have a further per centage against them in the weaving. It is considered excellent weaving here when the finished cloth holds out three yards in four for the loom length, whereas in England, it fulls in only two yards in nine, on the length warped.

Weaving is seldom more than tolerably well done in this country, and the greater part of it is wretchedly performed, and it would be a great advantage to the woollen manufacturer, could a machine be invented to perform the work. There was something of this kind in operation at a Mr. Shepard's factory, Northampton. Mass. and the cloth woven on it, appeared to be very passable, quite as good as that which was done by hand in the same factory.

BRAYING.

THE process called braying, is that by which the grease and sizing are scoured out of the flannel. When a piece comes from the loom, it is said to be in the say, and it ought to be scoured out as soon as possible. Should this from any circumstance be delayed, it must be dried and laid by till wanted: it should never, however, be permitted to lie long, either wet or dry; for when wet it taints, and when dry, the oil will oxidize, when the wool will turn yellow, and the oil become so hard as very much to increase the

difficulty of removing it from the cloth. The impurities to be scoured out are the oil used on the wool, and the sizing used to stiffen the chain. The materials employed to remove them, are hog's-dung and human urine. A cask is about a quarter filled with dung, and then filled up with urine; they are then well stirred together, and left to get stale, being fit for use after standing a few days, yet the older they are, the better. At the time the cloth is folded into the stocks, pour upon it as much of this liquor as will be necessary to wet it, and cause it to turn; the hammers are now suffered to play for a few minutes, till the cloth is wetted equally in every part, after which it is taken out, and its lists pulled square. The lists are now thrown to the centre, and the cloth thrown into a circular heap, and left in that position until the urine has entered into combination with the oil, which crisis may be known by wringing a handful of the cloth; when the liquor wrung out, is of a milky appearance, the desired union is effected, and the cloth is again put into the stocks, and more of the liquor is added until it is wetted throughout; the hammers are now permitted to play for one hour, unless the expected effect is produced in a shorter time, after which, a small stream of water is introduced into the stocks during twenty minutes; then the plug is taken out, and water is introduced freely until it runs off perfectly clean.

In general, this urinous liquor and water are sufficient to cleanse a cloth from its grease; but when the wool has not been properly scoured from its yolk, or filth, or when the cloth has been manufactured a great while, it is necessary to add to the urine a solution of fuller's earth, and to do it sometimes two or three, and even four times over: notwithstanding which, it is almost ever necessary to work such cloth twice more with earth, prior to fulling; but this is done only after it has been burled; at all events, the operation is always finished by letting the water run freely into the stocks. In order to know whether a cloth in the flannel is in a fit state for washing, after it has been worked in the stocks for half an hour, dip a corner of the cloth into a bucket of water, rub it between the hands, repeat it several times, and then expose it to

the light, looking through it, and if no yellow, grey, or black streak or stain appear, you may wash it as before directed; but should there be any such appearances, the hammers must continue to play until it is fit.

It is important that cloth should be thoroughly free from grease before it be fulled; for soap, which softens grease, but does not dissolve it, forms with it a clammy, semi-soponaceous compound which adheres very strongly to the cloth, and is scarcely ever to be removed by any subsequent operation. In some places on the European continent, where good earth is not to be procured, they scour the cloth with a soft black soap, although it be a miserable substitute for earth.

It is important that cloth should not full in whilst it is undergoing the process of scouring; to prevent this, it is necessary to attend to it whilst the hammers are playing, and when it begins to get warm in the stocks, it must be handed out and pulled by the lists; the hammers must play on it slowly, and a little water must be let into the stocks. When cloth is suffered to become treated in the stocks, while scouring, and it fulls in, the burlers cannot take off the knots, nor draw out the double threads, without making such holes as will not close in the fulling, and the cloth will necessarily be imperfect.

In some places they suffer the cloth to soak during three, four, or more days in a river, after it comes from the loom, in order to dissolve the glue with which the chains have been sized.

Attention must be paid to the cloth when heating in the heap, for should it be permitted to become too hot, with the size in it, the cloth will soon be injured. A few hours in warm weather will effect the desired union of the grease and urine, and if it be permitted to lay long in the heap after this has taken place, the texture will be destroyed.

The mode of wetting the cloth with the urinous liquor varies according to the whim and fancy of the workmen; some wil throw the liquor on the face of the cloth, fold it up, and tread it with their feet; others again perform the operation altogether in the fulling mill, permitting the stocks to play on the cloth until the grease combines with the ammonia of the urine. It is of little consequence how the process may be varied, provided the cloth be equally well cleansed from its grease.

Braying is a chemical operation which I shall endeavour to explain for the satisfaction of any scientific manufacturer who may peruse this work. The urinous liquor undergoes a fermentation, which is accelerated by the glue used in sizing; the ammonia of the urine, assisted by heat, combines with the oil, by which an ammoniacal soap is formed that will readily wash out in water.

The urinous ammonia and oil are both liquids of less specific gravity than water, and, when combined, the product is a soponaceous semi-liquid of greater specific gravity. It is well known to my chemical readers, that when a change takes place from a liquid to a solid, a large portion of caloric, or the matter of heat, is given out, and that the quantity liberated is in proportion to the increased density of the product; it follows, of course, that during the combination of the oil and ammonia, caloric is liberated: this added to that which is developed by the fermentation accounts for the great heat engendered during this process, which in a few hours will become so excessive, in warm weather, and in cold when permitted to lay longer, as to be too hot to handle; and if not checked, will soon decompose the wool, and destroy the texture of the cloth. We cannot be surprised at this destructive effect when we know that wool is altogether composed of animal fat, assuming its present form by some inexplicable organization; for it is nothing more than a progressive action, continuing to operate on the wool, after all the oil with which it was sheathed, has been decomposed.

The Messrs. Haights scour the grease out of their carpeting with

steam. Having seen steam tried for fulling, and given up as producing an injurious effect on the fabric, I was particular in making inquiry of their mode of braying: the result was, that the grease is raised in their carpeting by steam being let into the machine in which they cleanse the carpeting, and I understood without urine or any other material to assist it.

I shall not venture to recommend manufacturers to adopt this mode of braying, although, were I engaged in the business, I should try it myself; for as the success of the operation depends upon using steam at the temperature of about 100° Fahrenheit, it is probable that workmen would not do justice to the experiment, and it is very likely that when worked even at this low temperature the cloth would full in so much as to prevent the burling. I am of opinion, however, that steam heat with fullers earth would very successfully cleanse grease out of cloth; for it is well known that moistened earth, at such a temperature as they use, will readily combine with oil, and also that it has rather a tendency to keep the fabric open than to felt it. Sheuld this opinion, on trial, prove to be correct, it will be no small advantage to the manufacturer; for, as this earth has been lately found in inexhaustible beds on the North river, and can be purchased in New York at one dollar per hundred pounds, it will be as cheap as urine—will be much more certain in its operation, and cannot endanger the safety of the goods.

DRYING OF CLOTH BEFORE AND AFTER BRAYING.

BEFORE describing the process of burling, I must give some direction on the effect produced by exposing the flannel partially to the sun whilst drying. When cloths have been dyed drab and several other light colours in the wool, or having been woven white, are intended to be dyed such colours in the cloth, it is necessary to be very particular in drying them; for, if some parts of a cloth

be exposed to the sun, and other parts lie in the shade, that part which has been exposed will be of a different colour from that which has been shaded; it will be yellower, and is said to be sun-bleached, and must be re-dyed some other colour before the defect can be covered. This extraordinary fact is well known by every respectable manufacturer in the west of England, but I believe has never before been noticed by any writer on the subject. It is usual, when such goods are made, to have them hung on tenters to dry, or rather on hanging racks, having but one range of bars placed on the top of eight feet posts, in which hooks are driven, one for every three feet, and every other one being on the back of the bars to prevent the wind blowing the goods off. The right side is placed in the shade, the wrong side only being exposed to the sun. In certain other light colours this defect is never perceived, which is the case with scarlet and all those where a large portion of acids are used.

I shall attempt to explain theoretically the change which is here produced on the wool. It is more than probable my theory will be defective, yet if it should give a clue to some able chemist to explain it more scientifically, it cannot fail of being serviceable to the trade.

We know that when fat of any kind is long exposed to the action of the atmosphere, it will become oxidized that the lightest coloured oils, and the whitest fat, will by such exposure, gradually lose their colour, and become yellow, and that when exposed to the sun such changes are produced more rapidly—we also know that wool is composed of an animal fat liable to be acted on by alkalies, in the same degree as are other oleaginous substances; it necessarily follows, that those parts of cloth which have been exposed to the sun, will have oxidized more highly than other parts which have boen dried in the shade; and there is also a striking similarity in the effect produced; for the cloth as well as the fat has been yellowed.

I have before mentioned that some few manufacturers never permit their woollen cloth to be died in the sun, from an apprehension that it is thereby hardened, and the fact I have now described, affords a strong proof in favour of their opinion.

BURLING.

AFTER a say has been brayed and dried, it has to be taken to the burlers, whose province it is to take off all the knots from the face of the cloth, and to take out all the double threads, if any there are; in doing this they must be careful not to make holes in the cloth; when the cloth burled has been wool dyed the lints also must be picked out.

Burling is performed on a board about three feet wide and ten feet long, placed on a stand having four legs, and inclined about forty-five degrees. This work is altogether done by women, and the instruments they work with are called burling irons. When a piece is begun, as much of the cloth is placed over the board, from the back of the stand, as will cover it nearly to the bottom, the head end or forrel extending a little below it. On the upper edge of the board some fine worn out scribbling card, or dog fish skin, is nailed on, to prevent the cloth from slipping over whilst the women are at work; below the centre of the board, at each end, a hook is fastened to twine; the end of the twine is secured to the ends of the board. These are intended to stretch the cloth and to keep it in place breadthways. The cloth faces a good window-light, and a window-seat of the length of the board should be fixed for the women to sit on whilst at work. When all the knots are taken off, and all the double threads drawn out from the breadth first placed upon the board, another succeeds it, and so on till the piece is finished.

When a breadth is finished and before replacing it with another,

it is marked on the top across the cloth, with chalk, if wool dyed, and with reddle or charcoal if white: the marking has for its object to show how far the work has been done, so that in drawing another length over, no part may be left unburled, nor any worked over twice. When all of one side has been done, the cloth is returned to the back of the stand, turned over, and the other side undergoes the same operation.

It is usual in many English factories to have the rough wool taken off the face and wrong side of the say, as well as the knots and double threads, which, I believe is not done any where in this country. Those who have this performed, consider that the cloth has a better face when finished than when the rough wool is left on, and this may be the case when raised by hand; but I do not believe it is any improvement when the nap is raised by the gig mill. The rough wool, however, should be taken off the wrong side, for, unless this be done, that side will have a very uncouth appearance when the cloth is ready for market.

After wool dyed cloth has been burled at the board, it has to be put over a perch and all the lints taken out with linting irons, of a make similar to those used for burling, only smaller, more elastic and finer at the points. There will be in all cloth more or less of white lints, which being primarily attached to the wool, is spun with it, and shows in the cloth when finished—all of these that possibly can should be taken out of the wrong side of the cloth; both sides must be looked over, the wrong first and then the right, and no lint must be permitted to remain in the cloth. After both these operations, it has again to be drawn over the perch, for the purpose of stopping, or closing all the openings made by the burling and linting; and if any large gaps have been made by the breaking of the threads, they must be fine drawn with yarn such as the cloth is made of. For such openings will not close in fulling; but will leave holes and thereby render the fabric imperfect. These operations of burling, linting, taking the rough wool off the wrong side, and stopping, are too much neglected in this country.

FULLING.

AS every manufacturer is acquainted with what are called fulling stocks, it will be unnecessary to describe them; yet, as I have observed many defective machines of this kind here, and still greater defects in the use made of them, I shall attempt to give such directions as will enable manufacturers to remedy those defects.

The stocks in use at Mr. Israel Crane's factory at West-Bloomfield, New-Jersey, are a good pattern for any person who may wish to have new ones erected, or old ones altered. They were made by Messrs. Cockerfair and Collins, of that village, and I believe the expense of workmanship, timber and iron work, is about one hundred dollars for each pair, being less than the value of the timber in England.

At many factories in this country, they full in a machine called a poacher, which may do very well for their country cloth, as sattinets, but as generally constructed, are not calculated for broad felts. I would recommend the falling-stock for braying, fulling, and scouring; and the poacher for washing out after these operations have been performed. The only poacher I have seen in this country that appears to be calculated to make good work, is at the Rahway factory: a large heavy double machine, having a quick motion.

Falling-stocks are always worked by a tappet wheel that is fixed on the main shaft of the water-wheel; for this machine can never be geared with safety. Each of the hammers should be calculated to fall thirty times in a minute, or sixty times the two hammers; for, if made to move much more rapidly, the tappets will catch the hammers before they fall on the cloth, and, if much more slowly, the want of sufficient friction will retard the progress of the work.

It is usual, in England, to have three or four sets of false backs, of different thicknesses, made to fit the stocks, to which they are secured by a long iron bolt passing through the sides of the stocks and through the upper end of the false back, the bolt being put in and drawn out by means of an iron ring, large enough for the hand to grasp it inside, and which hangs pendant from a hole at one end of the bolt. When a full quantity of cloth has to be fulled, none of these backs are put in; but when the quantity is smaller than sufficient to fill it, such of the backs are used as will reduce the capacity of the stocks to the bulk of the cloth, which is necessary to enable it to work without damage; for, when too small a quantity is put in, the cloth will not move round well, and will be liable to fall on the fenders, and, should any of the cloth happen to drop between them, which frequently occurs, it will be liable to be cut; and should it escape such accidents, the machine will, at all events, be injured by such working. When too much cloth is put into the stocks, it will not turn, but beat up into a hard, twisted, immoveable lump, and can scarcely escape without being damaged. The cloth should so fit the stocks as to move round freely, whilst working, and for the hammers to play on it so as not to strike the fenders.

Cloth may be fulled either with soap or urine, the former is generally used, and I have never but once seen it done with the latter. I shall describe both modes, that those manufacturers who are desirous of trying them may have an opportunity of doing so. Common white soap may be used for fulling, but, for fine cloth, I would recommend the Castile, which is now universally used in the west of England. This soap is made from Gallipoli oil, and, as is there well known, imparts a softness to the cloth which the other never gives. It is the white oil soap that is sold in New-York at fifteen cents a pound by the box, it is hard and dry, and may be considered as cheap as the common white soap at eleven cents. A fine say intended for a stout seven quarter felt, warped thirty-six ell, or fifty-four yards, and weighing warp and filling, seventy one pounds, if white, is allowed, five pounds of soap,

and, if blue, six pounds; and when of colours, in which much of the alum mordant has been used, or acid, tin liquor has been employed, then seven and even eight pounds are sometimes necessary. All other cloth must have soap, according to their weight, quality and intended substance.

A large plane is provided for the use of the mill-man, which he places across a washing tub, the edge side uppermost, and the soap is shaved by passing the bars over the face of the plane till all of it is cut up, which of course falls into the tub. On this, there must be as much boiling water thrown, as will leave the soap, when dissolved, of a gelatinous consistency. In this state it is used, after being permitted to cool; for on no account must it ever be used in a warm state. It is also frequently boiled, and then permitted to cool. The cloth intended to be fulled, must be opened with the right side uppermost, and on that side one half, or rather more of the liquid soap, is thrown on, as regularly as can be, all over the face. As this is doing, the lists are thrown to the centre, and, when completed, the cloth is put into the stocks, which are plugged up, and the hammers permitted to play. The cloth must be kept sufficiently moist during the operation with soap; for if kept too dry, or is worked with too little soap, the fabric will be gradually wasted, which will soon be observable by the quantity of dry flock that will accumulate about the hammers, cams, and other parts of the machine. Soap has also to be added from time to time as the fulling progresses. The cloth will have to be taken out several times during the process, as when too much heat is produced by the playing of the hammers, or when it has taken a wrong position in the stocks; beside these incidental handings out, it has to be taken out and put in again at regular periods. When the operation has continued two hours, the cloth must be taken out, the lists pulled square, and the breadth measured in several places, to ascertain if it fulls in regularly; should any part be found to prove slower than the general run, an additional quantity of soap must be put on that part, the lists thrown together as before, the cloth handed into the stocks, and

the hammers permitted to play during three or four hours. At all the regular handings out, the lists are pulled square by two persons who stretch the cloth breadthwise with their whole weight, going all along the lists. When this has been faithfully performed, and the cloth measured in the width, to ascertain if it proves fast enough and equal throughout the piece, in those places that are too wide, if any there be, after the first handing out, not only soap must be added; but if the the difference should be considerable, that part must be twisted like a rope, and placed in the stocks in that position. These operations of taking out, stretching, measuring, &c. are to be repeated every three or four hours, after the first regular taking out, until the cloth is finished. During the operation of fulling, the cloth must have a supply of soap sufficient to keep it, at all times, in good proving order, and this can be known only by experience. I have mentioned the quantity of soap necessary for the whole operation, and the workman must add it from time to time, as it is wanted, which, being circumstantial, cannot be described. A given portion is put on, when the operation commences, and some added as soon as the cloth begins to work in the stocks, until it appears to have as much as is necessary. If the cloth at the first handing out, should have fulled in too fast, none need be added at that time; if it should not have proved fast enough, more must be added, and the same will hold good at every handing out. At all events, the cloth must never be permitted to become too dry in the stocks, neither must it be too wet, there being a medium to be observed, which experience alone can direct.

About fourteen or sixteen hours is required to full in a piece of stout white felt, and from sixteen to eighteen hours for a blue, provided the fallers are properly made, and have a good speed. The pounding of the hammers produce by their friction a great deal of heat, which if permitted to raise too high, the fabric will prove, or full in too fast, and the texture of the cloth will be injured by being left hollow and spongy; therefore, in all such cases it must be handed out of the stock, opened, strrtched and put in

again. When cloth is fulled with too little soap, it will waste during the operation; it must consequently be at all times well supplied, and never permitted to full in too rapidly. The proof of good fulling is to have the fabric when finished stout and firm in the ground, like leather, and of an equal breadth in all parts. A piece intended for seven quarters, should be fulled into six quarters and a half, within the list, never exceeding this more than a nail, to allow for any trifling inequality in the fulling, that it may be equal when tentered. If the warp has been spun with sufficient twist, and the filling very loosely twisted, the cloth at the same time being well beaten up in the loom, a piece that has been warped fifty-four yards should hold out, when finished, forty-two; but this will depend altogether upon the perfection of the workmanship.

FULLING WITH URINE.

THOSE who full with urine consider that it improves the quality of the cloth, and imparts to the wool a peculiar softness which soap never gives: I very much doubt this theory. The workmanship, in fulling with urine, is the same as with soap; the former being used in place of the latter. Cloth that will full in with soap in eighteen hours will require twenty-four with urine, although the degree of heat be the same.

WASHING AFTER FULLING.

WHEN cloth has been fulled in, it has to be washed clean from the soap, and this apparently simple operation is seldom effectually done in this country. When it has been fulled white, and intended to be coloured, the dye will be injured should, any soap remain in it; and if it has been dyed a dark colour in the wool, and any soap remain in it, the colour will not show to the same advantage

as when it is thoroughly clean ; it will look mealy and light coloured ; for the soap which is retained in the ground, will reflect yellowish white rays, which mingling with those of blue, or any other dark dye, injures the beauty and intensity of the colour, and when bad, gives it a mealy appearance. Soap cannot easily be cleaned out of cloth with soft water only ; therefore, hard water, where it can be obtained, should be employed for this purpose also, for washing out after braying, and for cleaning in earth preparatory to dying. When hard water cannot be obtained, let the cloth be scoured out with fullers earth.

I recommended the use of a poacher at the commencement of the article on fulling, and in this part of the process, it should be employed. After cloth has been siged in the fullers for braying, and the grease has been properly raised ; also after it has been fulled in with soap, or worked with fuller's earth, it should be washed out in a poacher ; for it is in the washing, when the cloth is partly clean, and much swollen with water, that it is liable to damage under the fallers, as it then becomes too rough and bulky to work round freely. It is then much safer to take it out of the fallers, and put it into a poacher, where it cannot damage, if the machinery be in good condition.

Those managers of factories, who have had but little experience will be ready to say that I am much too particular ; but I can assure them that nothing has been stated, nor any precautionary measures recommended, which are not absolutely necessary to the perfection of the business. Those who clean their cloth as I have recommended, will find the appearance of their goods much improved, their credit much enhanced, and the profits of their business greatly increased.

FULLING WITH STEAM HEAT, INSTEAD OF SOAP.

A PATENT has been obtained in this country for fulling with steam. A conical wooden boiler is made, a smaller one of copper being inserted inside of the wooden one, and the whole is made water tight. The vessel is nearly filled with water between the wood and copper, and a fire is made inside the copper one, at the largest end; a short iron pipe being placed at the other end to carry off the smoke. A small tube conveys the steam from the wooden boiler, through the back of the stocks, to the cloth inside of it, and a cover on hinges is placed over the cloth to keep the steam down, so as to enter its folds while it is turning round. This steam apparatus was tried when I was at West-Bloomfield factory, several stock fulls having been felted with it; the cloth proved in a very short time, much sooner than when worked with soap. It appeared to give to the fabric a very firm texture; in fact the ground was too hard, and the staple of the wool was so much injured as to come off in large rolls when worked with jacks, or teazles. In consequence of these defects the system was given up by the managers.

When any new operation is discovered that may prove beneficial to manufacturers, it seldom works well, until the conditions upon which its success depends have been ascertained by long practice; and this is more particularly true, when a new operation is superintended by ignorant workmen, who are almost always so strongly prejudiced in favour of old systems, as to wish to put down new discoveries; and they are in some measure excusable, being under the impression, that their services, which before had been highly estimated, will no longer be of any value. The opinion of the managers is also often detrimental to the introduction of new machinery, and new modes of working. I remember when a lad, the first introduction of carding and spinning machines, in the west of England, for it created a very great sensation, both among master manufacturers and their workmen. The impres-

sion made upon my youthful mind, arose from the absurd conclusion adopted by the factory owners in the first place, and their subsequent recantation. One manufacturer had put the machines at work, and had kept them very close, non-admittance being strictly enforced. A public meeting was called by the most influential clothiers to take into consideration, whether or not cloth could be made from carding done by machines, and spinning done on the jenny, when they came to a conclusion unanimously, that it could never be made from work done by the said machines. The manufacturer who had them, kept on working them; and his cloth not only sold well in market, but it was discovered that he was making much larger profits than his neighbours. These circumstances being generally known, caused another meeting to be called, when they came to the resolution that cloth could be made by machinery, and from that time they were rapidly introduced. These observations in the opinion of a public body of men who were supposed fully competent to decide on a question relative to their own immediate calling, in which they were much interested, made at the time a strong impression on my mind, and produced a considerable degree of scepticism in human judgment, which subsequent experience has rather confirmed than removed.

It is by no means advisable, nor would I recommend manufacturers to be hasty in trying every supposed improvement which may be offered to their notice, yet when a new discovery is proposed by a respectable person, that carries on the face of it a probably successful issue, attended with great profit to the business, it is their imperious duty, if they attempt it at all, to give it a patient and fair trial.

The experiment made at Bloomfield, to full by steam, was superintended, not by an experienced workman, but by a person who understood nothing of fulling; there were consequently no prejudices to encounter; but there was that which was more than tantamount to it, ignorance in the operators. I looked on at every convenient opportunity, and although it was given up, yet I ar

convinced it might be made to answer, and that very effectually. Having expressed this opinion, I shall give my reasons for it, and endeavour to show, that in the trials made in that factory, the conditions on which fulling usually succeeds, were not observed. It is known by every experienced millman, that when cloth becomes too hot in the stocks, it will full in so fast as to injure the fabric. I have never ascertained the requisite heat by the thermometer; but, from having frequently handled cloth that has been experimentally pronounced to be in good proving condition, I should judge the requisite heat to be between one hundred and one hundred and ten degrees. The steam let into the stocks, in the trials referred to, was, as I have been informed, nearly, or quite at a boiling heat, or more than two hundred degrees, being nearly double the heat that good fulling requires. This accounts at once for all the defects in the cloth done by them. The wool instead of gradually creeping up into shorter lengths, was forced in too rapidly, and the hairs became matted together, as in hatters' felts: the staple also was injured, by being pounded for so many hours, in so high a temperature. The first and second effects made the ground of the cloth too hard, and the third caused the wool to roll off when acted upon by the card and teazle points.

To try this mode of fulling fairly, a thermometer should be inserted in the tube conveying the steam from the boiler to the stocks, and the operation should be attended by an experienced and liberally minded millman, as well as by an intelligent manager: the former to attend the cloth whilst working, and the latter to see that the temperature of the steam is kept at a proper standard all the time. Let the first cloth be fulled at one hundred degrees and the heat be increased every fresh piece five degrees until the maximum is found, and I am much mistaken if it would not prove that this is the best possible way of fulling cloth. When the proper temperature has been once discovered, a valve should be fixed in the wooden boiler, that will lift at the requisite heat, by which means the machine would ever after regulate itself, nothing being left to chance, nor to the neglectful habits of workmen.

It was not originally my intention to have said so much on this subject, being aware that such long digressions are often blameable. Yet if the opinion I have advanced be correct, and should be the means of introducing a mode of fulling that would save in the aggregate many thousands of dollars per annum to manufacturers, it will not be considered as useless.

DRESSING, OR RAISING THE NAP OF CLOTH.

RAISING the nap is that operation by which the right side of the cloth has all the disposable wool drawn to and laid on it, in one direction, from the last to the head end. This is performed either by hand, which is called dubbing, when done on a dubbing board, and timming when done with a timming hog; or it is done at a machine known by the name of gig-mill, when it is called gigging. This work can never be well executed by hand on a stout and fine cloth, unless at such an expense as would make it folly to attempt it. Hand work is so expensive that no English manufacturer will employ it, unless where, from the refractory disposition of the workmen, they are not permitted to use the gig-mill; much less ought it to be adopted in this country, where wages are full forty per cent higher than in England. Hand work being so expensive, as to preclude its being employed here, I shall confine my description entirely to the gig-mill, and to the mode of working it. The American manufacturers are, in general, ignorant of this branch, therefore, I shall attempt to explain all that may be necessary to make them understand the operation: yet, as practical judgment is necessary in this, as well as all other branches, I feel compelled to reiterate what I before enforced, that those managers who mean to excel, must devote all their time and attention to make themselves practically acquainted with the business, more especially so far as to enable them to know how work ought to be done, and when it be well performed.

In describing the gig-mill, I shall treat of it under four distinct heads: first, of the machine and gearing; secondly, of the teazle and handles; thirdly, of supplying the cloth with water, whilst at work; and lastly, of the work given to the cloth.

I am so little accustomed to describe machinery, and so much unacquainted with mechanics, that I feel at a loss how to make this part so clear and plain to my readers as that they shall not mistake my meaning. I hope, however, that the most material parts will not be misunderstood.

The barrel of a gig-mill should not be less than two feet ten inches, nor more than three feet in diameter, when complete. The centre is a stout square iron shaft, with arms of the same metal, extending from it, at short distances from each other, to support a given number of strong circular iron hoops. The arms are permanently fixed in the shaft, and the hoops rivetted to the ends of the arms. Around the hoops are placed wooden frames for holding the teazle handles, which lie the length of the machine, crossing the hoops at right angles: these frames are permanently secured to the hoops, and they are made so as to put one end of the handle into a square aperture covered with thin sheet-iron, and the other end placed in an open aperture secured by an iron hook, suspended from a steel spring, that is fastened at the back of the frame. The barrel should be six feet three inches in length. At the right hand of the barrel, standing at the front of the machine, the gearing is placed. In England this is made with two friction wheels, one permanently fixed to that end of the shaft of the barrel, which is elongated for the purpose, the other being attached to gearing, from the water wheel, and so fixed as to recede from, or approach the other by means of a lever. When the barrel is wanted to be worked, the latter is thrown into the inside of the former, to which it communicates its motion. There are two rollers, one above the barrel of the gig-mill, rather at the back of its centre; and the other under it, similarly situated: into holes, notched out on the lower roller, tenter hooks are driven, so that their points shall be

below the level of the wood, to prevent the cloth from being torn. On the upper roller is fastened, by means of hinges, a swinging strip of wood, the length of the roller, having three or four links of flatted chain attached to it at both ends, and when fastened to the roller, the strip hang pendent from, and every where parallel to it. Tenter hooks are driven into this strip with the same precaution as is used in fixing them in the lower roller. These rollers are geared, by means of cog and friction wheels, to the main barrel of the machine, and the swinging strip before described, falls into a groove, cut in the roller, when brought up by its moving round. The rollers have a quick or slow motion, at the will of the workmen.

The handle frames are made so as to hold three rows of teazles each, and are divided into two parts or sides. The centre is a piece of hard wood, of an oblong square, about an inch deep, and three quarters of an inch wide, at the thickest part. They are grooved on the sides, for the purpose of letting in that part of the circle of the teazle that presses against it, so as not unnecessarily to break down the points. This centre piece is from five to six inches long; about an inch from the upper end a hole is drilled for the purpose of letting through a small round rod, the size of a small pipe stem, made of tough wood, such as dry young white oak; it should be about nine inches long, having a swell at the centre, so that when driven in, it may remain permanently fixed. At one inch, or rather more, from the lower end of the cnntre of the handle, tenons are cut lengthwise of the piece, to let in two thin slats of tough wood. The centres, where it passes through the upright, should project so as to meet, and the other parts should be cut so as to leave an opening sufficiently wide to let in the stalks of the teazles. Each end of the rods, and of the slabs, are notched sufficiently deep to tie large twine round them, but not so as to endanger their breaking. The stalks of the first row of teazles are put in between the slats, the bottom part of the heads being pressed against their edges; the stalks of the next row are forced in between the teazles of the first; and of the third between the second.

When the whole of one side are in place they are tied down with twine, from the end of the rod to the slats, so firm that the motion of the gig-mill barrel will not shake them out: both sides of every handle are filled in the same way.

Below the gig-mill barrel, and in front of it, a leaden pipe, of an inch bore, is laid along, supported against a wooden bar. This pipe has a number of small holes in it, through which the water streams out with such an angle of elevation as will force it on the cloth just as it enters on the barrel. At the right hand, immediately within the post of the gig-mill frame, a brass cock is placed in the pipe, to enable the workman to let on and stop the water at his pleasure. From the cock the pipe is either led up the post, or let into the ground, and continued to a reservoir of water, which should have a head of at least six feet above that part of the pipe which passes in front of the cloth, in order that the weight of the column may be sufficient to force the water so hardly against the cloth as to drive through it.

The barrel having been filled with handles, and well secured, the cloth intended to be dressed, is placed on a slatted barrow, six feet by three, fixed on a swivel rising six inches from the floor, so as to move round when the cloth is on it, in order that when half a course has been given in one direction, the wet cloth may be turned to reverse the end, without obliging the workmen to reverse it by hand. Before the cloth is worked, pieces of white canvass are sewn on to each end of it, sufficiently long for the cloth to reach to the middle of the barrel of the gig-mill, when it is hooked on the tenters. This being done, and one canvass hooked on the lower roller, the machine is thrown into gear, and the cloth, so far, wound on the roller, that the canvass at the other end will reach so as to admit of its being hooked on the upper one. Whilst the latter end is hooking on, the machine is thrown out of gear. When every thing is prepared, and the box at the end of the friction lever is weighted, so as to produce the necessary strain, the machine is thrown into gear, and the cloth passes very slowly from

the lower to the upper roller, the main barrel in which the teazles are placed, meeting the motion of the cloth. When the whole length is up so that the lower end of the cloth comes on the teazles, it is rolled back again, with a quick motion, by means, which I am not mechanic enough to describe. Six of these runnings up in one direction, on one side of a set of handles, and then another six runnings up in the opposite direction, with the other face of the handles to the cloth, is called a course in Gloucestershire; but in Wiltshire they term five runnings up each way, a course. I must beg of manufacturers, to be particularly attentive to this part of the subject, as it includes that in which they are more immediately interested. I have stated, that what is called a course of work, includes twelve runnings up at the gig-mill, from the lower to the upper roller, six from the head end to the last end of the cloth, and six from the last end to the head end, with handles reversed. Before I progress, it will be necessary to describe how the handles are arranged, cleaned, and dried.

There should be prepared for every gig-mill, at least three sets of handles, each set containing ten courses, that is thirty times as many as will fill the barrel of the gig-mill once. When a course has been given to a cloth, the handles are taken out, they are cleaned from the flocks with an iron comb, by a small boy, and are then put up to dry. For the convenience of drying, narrow sheds are provided, open on all sides, having a close, shallow roof, which is placed on the top of two posts standing six feet distant from each other. Between the posts are placed double slats, each pair just far enough apart to admit the longest leg of the centre of the handle, with space enough to go in easy, or about two inches asunder; on these the handles are placed in an upright position, when dry. After the handles are taken out of the gig-mill, having done the work of one course, they are first laid hollow, the heads of two leaning on each other, and slanting off in an angle of about twenty-five degrees, and when quite dry, they are placed upright, close together, and each pair of slats should, when so placed, hold as many handles as will fill the gig-mill barrel once. It will be seen,

that six of these sheds, each containing five pair of slats, will be wanted for the handles of each gig-mill. To prevent the slats from flagging in the centre by the weight of the teazles, they are passed through an upright inch board, which also helps to support the roof. I scarcely need mention, that these sheds should be placed near to the workmen, and where they will be most exposed to the air, to facilitate the drying.

Workmen and managers will think they can do with a smaller number of handles than I have directed for them; but they must consider that handles and sheds are cheap and durable, and that teazles are dear and soon worn out. They are, probably, not aware how much longer teazles will bear working when thoroughly dried, than when re-worked in a damp state, and that it is not only necessary the spurs should be dry, but the head also which supports them; for unless this be dry, the spurs will either break off and leave them pointless, or they will be so limber as not to stand to their work. I do not wish to make manufacturing more expensive than it now is, but, if possible, to lessen the expense, and nothing will contribute to do it more effectually, in this department, than having a full complement of work, and proper drying conveniencies.

The quantity of work that is required for each piece, must be regulated by the judgment either of the manager, or of the workman; for that which would be no more than necessary to raise a good nap on some cloths, would tear others to pieces. The work, as I have before said, is calculated by courses of twelve runnings up, the ends of the cloth and the handles being reversed every six runnings up, the last six being always from the last to the head end, so as to lay the nap in that direction, in which it has finally to remain. Before a cloth is begun, the barrel must be clothed with dead work; that is, the handles of the first course has to be filled with teazles, whose points have been made quite tender by previous working. Every course that succeeds it, must be filled with

better and better teazles, the handles of the last being one-third of them set with new teazles, and in some cases, where the cloth is very stout, it will require two-fifths of new ones.

For raising the nap effectually on a piece of stout felt, forty two yards long, from ten to twelve courses are required, or from one hundred and twenty to one hundred and forty runnings up. Other fine cloth not so stout must have work in proportion to its substance. To know when a piece is sufficiently dressed, open the pile and examine the ground of the cloth. If the wool be so cleared out that the upper parts of the chain threads are distinctly seen, unclogged with wool, then it is well raised; but if the ground be still clogged with wool, it must have more work. An experienced workman will know when the nap is well raised, by placing his hand on the cloth above the barrel; when it feels very mellow and soft, it is considered to be sufficiently dressed; but so long as it feels stiff and hard, it will bear more work. This criterion cannot well be described, and can only be felt by those who have long experience; therefore, it is better to be governed by the former criterion, which being visible, is much more certain, and more readily acquired.

When a perfect nap is raised on a piece of thick, fine, firm cloth, the face is well and closely covered, and equally so in every part. When the nap is thin on stout cloth, it proves either that it has not been sufficiently raised, or that much of it has been taken off by defective workmanship. The latter will be the case when the cloth has been worked too dry, or when the teazles used in the first courses have been too strong. Under either of these circumstances the wool will be dragged off the face instead of being drawn out and laid on it. It is therefore necessary always to keep the cloth well filled with water during the whole of the operation, and some manufacturers keep the strainer running on it more than one half the time, others again only occasionally; but at all events, it must ever be kept quite moist. When a cloth comes

from the fulling-mill, the wool is always closely matted together in the ground, and if in the first courses, the work be too strong it will tear it out with a force sufficient to break the staple of the wool; but when dead work is used in the first courses, and the strength of each is gradually increased, the hairs are gently drawn out in succession, and comparatively, very little is taken off. The French, in order to avoid this, give more time in the working, and use more of dead work than the English. They give the cloth three or four dead courses, then cut a wet kerf, and repeat with better work, until it is finished. The English are about eight hours in raising the nap of a fine stout felt, and the French are from twelve to sixteen. A French cloth, therefore, of any given fine quality, has a better nap on it, and a much finer face than the English. I am aware that in making this assertion, I am treading on very ticklish ground; but the fact is well known in London by every respectable trader in the article, and I can see no reason, excepting sheer national prejudice, why it should not be candidly acknowledged in a work of this description, having for its object to instruct manufacturers in the best mode of working.

When a stout cloth has been raised with due regard to the foregoing instructions, it will, when finished, have a fine water gloss on the face, superior to hot pressing, and which wearing will never remove.

In many of the gig-mills I have seen at work in this country, the ends of the cloth are sewn together, or otherwise fastened with long slender needles, and it keeps going round by passing over one, or between two rollers, placed above and at the back of the band, from whence it falls down on an inclined plane to the pit below. It is from thence drawn slowly forward over a bar placed underneath the barrel, a little forward of its centre, and it continues going slowly round until the workmen stops it to give the cloth an opposite direction, or to put in new work. This is by no means a bad way of raising the nap, and I should consider it equally as good as the process I have described, provided every other part

were equally well managed: but there are many defects which I shall presently describe.

A gig-mill that is under proper management, and with every thing well regulated, ought to raise the nap of sixty yards of broad cloth every day, and that with but little expense for workmanship. This would be eighteen ends of broad cloth per week, or about as much as could be made by three billies. I will first describe how they manage these things in that part of England I came from, where no other kind of dressing is known, and then point out the defects in the process as pursued here.

In that country, a millman, the person who undertakes to full the cloth, has the raising of the nap also, which he does in some factories by the piece, in others by the day. Where done by the piece, or day, the twine, soap, and teazles are found by the manufacturer. The millman, with a lad of sixteen, and a boy of ten or twelve, will do all the work of two pair of stocks, and raise the nap of the cloth fulled in them; that is, they will full and raise the nap of eighty four yards of cloth per day, or twenty four ends per week. It is true they work eighteen hours out of four and twenty; but they get through with the work, and no manufacturer would think of having more strength employed to perform it.

Let us see how they get along with these things here. At a manufactory in New Jersey, where they make nearly twelve ends of cloth per week, and where they boast much of their management, they employ a mill-man to work one pair of stocks, and five men and one or two boys to raise the nap. Four of the men are constantly employed in raising, by hand, at two trimming hogs, and one man and a boy work the gig-mill. There are then six men at seven and a half dollars per week each, and two boys at two dollars, employed to do half the work that is done by one man, one lad, and one boy, in England, and when the cloth is finished, the nap is not half so well raised here as there.

I would seriously ask those managers who are working in this way, whether they expect, by pursuing such a system, to be able to compete successfully with the importing merchant? It is true, at the present time, they are able to do so; but this opportunity may be gone before they are aware of it. With a protecting duty of twenty-seven and a half per cent, and an exchange of ten, such concerns are enabled barely to get along with a tolerable profit: and this would not now be the case, provided articles could be found to exchange with Europe, to allow of a more extended importation. How soon the state of things may change, it is impossible to foresee; it, therefore, behoves our manufacturers to lessen their expenses in every possible way, whilst the profits of the business afford them the opportunity, in order to be enabled to enter successfully into competition with foreign manufactures when circumstances shall become less promising.

I do not wish to alarm the capitalists engaged in this business, yet it is necessary they should be aware of the ground they stand on; for it is in their power, by making timely exertion, to establish themselves so permanently that no foreign competition shall shake their stability.

The gig-mills, and the manner of using them, are miserably deficient in this country; the barrels every where, so far as I am acquainted, are much too small, many of them being only two feet diameter, instead of three; the cloth, instead of wrapping round nearly half the barrel, as in England, is never set to come in contact with more than one-fifth, and in many of them, much less; the barrel, which, when three feet in diameter, should make one hundred and twenty revolutions in a minute, does not often make more than eighty, although only twenty feet; the handles in which the teazles are set, generally contain but one row, and never more than two, instead of three. I have never seen a regular set of handles for the necessary courses in any factory in this country and the handles are seldom well supported behind, so as to keep the points to the face of the cloth. It is not surprising, therefore,

under all these defects, that manufacturers should be disappointed in the working of their gig-mills, or that they should conclude hand work was better. We will calculate on the consequences attending these defects, to show that the fault is not in the machine, but in the mode of framing, gearing, and working it.

It requires eight hours constant working, to raise the nap effectually on a piece of felt, measuring forty yards, with an English gig-mill, having a three feet barrel, and moving with a velocity equal to one hundred and twenty revolutions in a minute. With one, therefore, of only two feet, supposing it to have the same speed, it will require twelve hours to produce the same effect. The one revolving one hundred and twenty times in a minute, and the other only eighty, will extend the time to sixteen hours; and as the cloth wraps as much again round the English barrel as it does round the American, the latter will give us thirty-two hours. Supposing two rows of teazles to be fixed in the handles instead of three, this will bring it to forty-three hours, and where only one row to fifty-three. This added to the want of regular sets of work, and to the handles not being properly supported at the back, will make the total at least, fifty-six hours, or seven times as long as is required at the English gig-mill. If this were all, it would require only time and patience to produce the same effect; but it has been proved, by experience, that a slow-motioned gig-mill will never raise a good nap on cloth, and, however strange it may appear to those who are not experienced manufacturers, there is a much larger portion of nap robbed from the face of cloth, when worked with a slow, than there is when worked with a rapid motion.

To enable cloth to stand the work of a gig-mill, it must be wove true and square on the loom, each list having an equal strain and length, and the lists must be made strong and with sound material, or they will be cut to pieces before the nap is half raised.

A very passable nap may be raised by hand, when the work is faithfully performed by a workman who understands the process,

It requires as many, or more courses of work in this operation, as when performed by the gig-mill, beginning with dead work, and progressing to that which is quick. The great error in raising the nap by hand, lies in the workmen not giving half work enough, and beginning to clear out with strong teazles before the proper time. The result of such mode of working, is a thin, coarse, straggling nap, which, when cut down low enough to wear smooth, leaves a bare thread, and if left long enough to cover the ground of the cloth, will wear very rough.

TENTERING.

WHEN the nap has been sufficiently raised, the cloth must be tentered for the purpose of drying it. This operation has also for its object, to strain it so much in length and breadth, as will make all parts smooth and even; for were it dried without being fixed in a frame and stretched, the cloth would shrink up unequally, and leave it so rough and wrinkly, that it could not be sheared without cutting, nor pressed with an even face.

A cloth intended for seven quarters, being fulled into six and a half within the lists, is stretched to seven in the tenters, and is pulled in length, one yard in twenty beyond what it measured when it came from the stocks. When set in the tenters, stretched, and hooked, the face is sprinkled with water, and then run from the last to the head end, first with fine cards, and then twice with long brushes made for the purpose. As soon as a cloth is dry, it should be taken from the tenters, particularly in the summer season; as being exposed long afterwards, hardens the face, by making the wool dry, harsh, and brittle.

SHEARING.

THE intention in shearing, is to cut down the nap which has been raised by the gig-mill. This has to be done so as to make it very short, yet to cover the ground of the cloth so completely, that none of the threads may show. The thicker the nap is, and the lower and more even it can be cut, so as not to lay the threads bare, the better. This is performed either by hand with a pair of sheers, or by machinery. Hand-work is so expensive, that in some countries, in England, it is entirely laid aside, and would be, in all of them, if the workmen would permit it. The nap is cut down gradually, each cutting over, being called a kerf, and fine cloth requires from five to seven of these, the wrong side also being cut one kerf.

There are many shearing machines in use in this country, no less than eight or ten having been patented in a few years; but none of them perform the work any thing like so well as the first patented English machine, called Harmer's shearing frame, on which two shears work exactly in the same way as by hand, excepting that the bobs move by mechanical motion. In this way, one lad of sixteen can attend two frames, working four shears. Two other shearing machines, that are occasionally used, have been patented in England, one is an improvement of Hovey's, the other had just come out when I left that country, and was pronounced to be much superior to either of the others. It worked with knives about twelve inches long, placed on the machine diagonally, so as to include the whole breadth of the cloth, which passed under them from end to end. The sample pieces cut with it were said to be better executed than any work of the kind ever before seen; and it cut a kerf over twenty yards of broad cloth in fifteen minutes. The machine was very expensive, the price, I believe, being about one thousand dollars.

Of the machines, used in this country, Swift's is undoubtedly the best. It cuts more cleanly than any other shearer I have seen, and

when worked with a motion sufficiently rapid and regular, and the edges of the working and ledger blades are in good order, it performs what may be called good work. It is essential, in all such machines, to take care they do not traverse faster than they cut, for, whenever this happens, the nap will be left in ridges; and although this may partially be removed in cutting the subsequent kerfs, yet, to a nice observer, accustomed to the business, it can easily be discovered when the cloth is finished.

It is a great object, in shearing, not to have the nap dragged out by the machines whilst they are cutting. This will always be the case, more or less, when cloth is cut with blades whose edges are dull. It is, therefore, essentially requisite, whatever machine is used, that the edges be always kept in good order. For want of this, the best constructed machines will do bad work. The machine most generally used in England, next to Harmer's, is Hovey's, improved by Lewis. The cutting blade in this is very small, and made of the best steel. It is wound round a polished iron cylinder, two inches diameter, in a spiral form, and is secured at the ends. Lewis, the patentee, sends three of the blades with each machine, and he engages to keep them in order for a trifling sum per annum. When one edge begins to get dull, it is taken off, another put in its place, and the dull one sent to the machine maker, who puts it in order, and returns it, so that the manufacturer is always supplied with good edges, at a trifling expense, and without any trouble to himself.

I would recommend some such plan to Mr. Swift. Let him provide two or three cutters to every machine, and employ, in the capital of every state, where manufacturers are numerous, some able workman to keep the blades in order at a moderate annual expense; by these means the sale of his machines would become more extensive, and the work turned out by them be much less objectionable. I should also presume that the workmen would be amply remunerated by a commission on the sale of the machines. and by the price paid for erecting and keeping them in repair.

BRUSHING THE CLOTH.

THE cloth, after shearing, is usually well brushed at a machine, made similar to a gig-mill, only much smaller in the barrel, and having three or four rows of brushes on it. It should have at least half an hour's work on each piece. Before it be brushed, all the lints should be taken out of the cloth.

OILING THE CLOTH.

CLOTH should be oiled before it is sheared, and afterwards, before it goes into the press, or when finished pressing. Some prefer doing it after pressing, because they say the oil soils the press papers.

For this purpose, the very best of oil is required, and, as little is wanted, the price of the article should be only a secondary consideration, the quality being of primary importance. The wool after braying, fulling, cleansing with fullers' earth, &c. will be very dry, and oiling not only softens the wool, but it makes the cloth wear better. Enough should be given in the first oiling to soften the nap sufficiently to make it shear well without giving the cloth a greasy feel, and the oil employed should have no rancid smell. That which is put on after shearing, is intended to penetrate the nap more completely, and is therefore well worked in with the brushes. It takes rather more than half a pint of oil for a piece of broad cloth of forty-two yards. Neats foot oil, when it can be obtained pure, is preferred for this purpose, and when this cannot be procured, the finest Florence is used, such as has little or no smell.

Many persons who purchase cloth, appear to object to its being oiled, and, when this is done with a rancid material, it is unquestionably objectionable. But as a cloth will never wear so well

without oiling, it is necessary to do so, and in order to avoid giving offence to the olfactories of the purchasers, the maker should always provide a scentless, fat oil, and take care that the cloth be not so crowded with it as to make it handle greasy. It is also usual to brush on the wrong side a small quantity of some essential oil, or essence of lavender.

The fine white looking oil, used by watch makers is very sweet when new, and is less drying than any other kind. It is said to be taken from some part of the head of the porpoise. Whether this can be obtained in sufficient quantity, at a price that will warrant the manufacturer's using it, I cannot say: it is, however, the best oil for this purpose.

PRESSING AND PACKING.

THIS last and very simple operation is seldom well performed in this country, and the advantages of superior pressing is but little understood, although without any additional expense, the face is thereby much improved. To have good pressing, the papers must be thick, very firmly put together, and highly hot pressed; the press made very strong, the screw large, and the means of levering down very powerful; and unless all these means are previously supplied, the best of workmen cannot put a good press on the cloth. The presses I have mostly seen here are not half strong enough to bear the requisite weight. The papers are usually so thin as not to answer the intended purpose. They should, at the least, be double, if not treble, the substance. The screws are seldom large enough to stand as much pressure as is required for good work; and the levers are neither long enough, nor sufficiently multiplied to give to the whole as much weight as good pressing demands.

I need not describe the manner of folding the cloth and putting it into the press, as these operations are too well known to need

any comment. When cloth is ready for the press, it should have been previously brushed quite clean, and all down have been whisked off.

After it comes from the press, or before it goes in, just as it suits the manager, it should be marked on the head end. Fine cloth is marked *best superfine*, and when very fine, *imperial Saxony;* it is usual, also, to add the number at one corner, and the name, or initials, of the maker at the other. To do this correctly, the letters are cut out on a strip of card board, and marked on the cloth with whiting, for coloured cloth, or with powdered starch.

The cloth has now to be folded up and packed either in paper or canvass, when it is fit for the market.

ON DYING.

THIS is an art of the utmost importance to the manufacturer, and one that will probably be the last in being brought to that perfection which it has attained in Europe. The works hitherto published on the subject, are by no means calculated to improve the art. Bancrofts is altogether a theoretical work, highly interesting to the dyer who has acquired a knowledge of chemistry, but is entirely useless to the mere practical artist. Doctor Cooper's is principally a collection from old absolete authors, such as Hellet, Macquer, &c. whose formula have been long exploded as too tedious in the operation, and too expensive for the practice of the present age.

I shall endeavour to throw as much light on the subject as the experience of twenty years will admit of. My knowledge in woollen dying has been altogether the result of personal practice, having been brought up to the business from my infancy, and the receipts given will be such as have come under my own immediate

notice, with the exception of some few wool colours, lately obtained from my English connections. Those for silk dying were given by a celebrated London silk dyer, and the cotton receipts were obtained from a first rate Manchester cotton dyer.

I shall begin by explaining those impediments incidental to a new country, just commencing the business, which have a tendency to retard the progress of the art, and which, when understood, may be easily removed. I shall then treat of the mordants, and dying drugs used in England, and point out as I go along, which of these are necessary to be employed by American dyers. I shall then endeavour to describe such native dye wares, as may be advantageously used by the artists of this country. The last and primary object will be the giving for every colour, such receipts as have been the production of my own and my brother's practice.

The impediments in the way of our dyers, consist in the valuableness of the water, the itinerancy of the dyers, and for want of the goods dyed being properly cleansed.

ON THE EFFECTS WHICH WATER HAS ON DYING.

WHENEVER this subject has been mentioned by theoretical writers, it has been but briefly noticed, as a subject of minor consequence, and their opinions have been uniformly erroneous.

I had no conception when I left England, that water could have had so material an effect in the production of colour, as I have since found it to possess. I have practiced the art in this country in four states, and have found that given proportions of the same description of ingredients, would not produce the same colour in any two; there would in each, be a considerable variation in the hue and body of the colour. I shall endeavour to draw such inferen-

ces from the facts that have been developed during my practice in both countries, as will carry conviction to every unprejudiced mind; and I humbly hope my opinion will be entitled to that consideration which the importance of the subject demands.

In a conversation I lately had with one of the Messrs. Haights, carpet manufacturers of this city, I was much pleased to find that his opinion on the effects of water, corresponded with mine in every particular. It was gratifying to have this opinion sanctioned by a gentleman possessing so much practical and theoretical knowledge, as it is at variance with all who have ever before written on the subject.

An idea has been handed down from the earliest writers, and reiterated by every one to the present day, that none but soft water is fit to be used in dying. They say that "if the water meant to be employed, be hard, and not fit for washing, or curdles soap, it is not fit for dying light colours." Although this idea has been taken for granted by every author, and been as generally received by the most intelligent practical dyers, yet it is altogether erroneous; and I will venture to assert, that spring water free from metallic oxids, and marine salts, is, however hard, better calculated for dying, than any larger stream having a distant source, however soft.

When I left England, I was impressed with the prevailing notion that none but soft water could be used for dying. It was the opinion of my father, and his predecessors in the same business, who have been eminent dyers for more than a century; and this in direct opposition to their own daily practice; for they had all this time been making use of spring water, that was very hard, would curdle soap, and was unfit for washing, in preference to water from a fine mill stream, that ran between the dye-houses, and was remarkably soft. And I am convinced they have owed their celebrity, purely to this circumstance. My practice in America has convinced me of this important fact, that any water, with the

exceptions before mentioned, may be used successfully by the dyer, with one proviso—that it is always in the same state. Water that is variable in its property, can never be used with any prospect of success: it is on this account that springs are better calculated for the purpose than mill-streams.

That river water is ever varying, is too obvious to be doubted. After much rain, by far the greater part will be rain water—in a dry season it will be altogether the produce of springs, and the shades of difference will vary almost daily. Can it be expected that a medium ever variable should be calculated to produce certain and invariable results? The dyer who uses river water (excepting in certain cases which will hereafter be mentioned) must, therefore, be subject to continual disappointment, and probably without the least suspicion of the cause. He will go blundering along for years in the dark, sometimes much to his satisfaction, at other times deceived in the expected results, he will blame the dye-wares; will expect they have been adulterated by the dealer, or will charge his workmen with carelesness and neglect; any and every thing will be suspected rather than the true cause.

Let every American dyer, that is stationary, contrive some mode of obtaining water that shall always be in the same state, and I will venture to predict they will soon become as eminent as those of any other country. This has already been done by Messrs. Haights of New-York, and the result, whilst it affords an example to all others, reflect infinite credit on themselves. I have never seen a dying establishment better systematised, or more happily contrived to answer every purpose than theirs. Their plan for collecting water and the modes contrived to have it always in the same state, are so masterly, and so consonant with the opinion I have been advocating, that I cannot elucidate the subject better than by giving a description of this part of their establishment, and the reason why they were compelled to adopt it.

These gentlemen are carpet manufacturers, and their dying is

done altogether in the yarn. When they first began their business, they were much plagued by the uncertainty attendant on their colouring. To obviate this difficulty was necessary to their success, and they considered the variableness of the water as the principal cause. The Manhattan water which they use, is pumped from springs, yet it was found to be variable, chiefly owing to its containing at times an unusual portion of marine salts. To ensure a regular supply, uniformly the same, they adopted the following mode: the water is first received in a large, open, oblong reservoir, where it is exposed to the atmosphere, and permitted to deposit its impurities: it is drawn off from this to a second reservoir, lying under the other, which is closely covered. The pipe that conveys the water from the first reservoir, is placed nine inches above the bottom, leaving room below it for the sediment to collect. Of course, none of the settled impurities can be drawn from the first to the second. It is pumped from the second to a third, which is placed over the dye-house, and sixteen feet above the lower one. The pump is so fixed as not to draw off, or disturb the water lying within nine inches of the bottom, and it is drawn for use from the upper receiver, with the same precaution not to disturb the sediment. The reservoirs are cleaned periodically; by these means they have been able to produce every colour, excepting madder red, with the utmost certainty.

These precautions are not necessary in the country, when access can be had to springs; and if river water were conveyed into ponds, seperated by means of sluices from the main stream, sufficiently large to hold enough for two or three weeks consumption, and drawn off for use twelve or fifteen inches from the bottom, every impediment to the success of the dyer, arrising from the uncertain state of the water would be obviated. Such a pond would require to be cleansed once a year, and the sediment would be worth as much for manure, as the expense of cleansing.

In scouring wool, the water used in the furnace should be soft, afterwards for washing, hard water is to be preferred. Rain or

river water is the best for one operation, and spring water for the other. The manner in which this operates, is the same as in rinsing of clothes after washing: every washer woman is aware, that she cannot get all the soponaceous filth out of her linen, unless they are ultimately rinsed through hard water. In the simple operation of washing the hands with soap, we find how difficult it is to cleanse them from it when soft water is used, and how readily it will wash off in hard.

In the dying of blue colours, soft water should be used in the vats. This exception is not on account of the colour, it is merely a saving of vegetable ferments. Hard water is not so favourable in promoting fermentation, as soft is, and when used in the blue vat, a greater than the usual quantity of bran and madder must be employed, or the fermentation will not be sufficiently vigorous. Hard water is best for washing wool after it has been coloured; it is preferable also for washing cloth after braying, and fulling; and where a convenient supply of spring water can be obtained at an easy expense, it should be led into convenient receptacles, from whence it can be drawn when wanted.

There is no colour in which water appears to have so much effect as in black. In the county of Gloucestershire, England, where the dyers are celebrated for this colour, the water holds in solution a considerable quantity of lime stone; and the same receipts used there, when employed in the adjoining county of Wilts, where the water is impregnated with an argillaceous matter, will not produce any thing like the same colour; and there is also a sensible difference in the colour, in the same county, from any given receipt when used in different places, and even in various parts of the same stream; for the effect is not the same when used near the source of a river, as it is at a greater distance from it. I brought three different receipts with me from England, two years since, one from each of the three best black dyers in the county of Glouoestershire, and only one of the three would produce a tolera-

ble colour with the water of a mill stream in New-Jersey. In the years 1805 and 1806, I became celebrated in the county before mentioned, for dying a fine black, and sold the receipt and business when I left, for three hundred pounds stirling: this receipt I also tried in Jersey, and it produced a better colour than either of the others, but by no means equal to that which I obtained from it in England. The principle colouring matter in black, is obtained from logwood, which appears to work browner in any other than lime stone water, and does not produce so much body.

It was my intention when I commenced this work, to avoid as much as possible, all theoretical explanations as being useles to the mere practical artist, and because this has been already performed by abler writers; but as the opinion given, has never before been noticed, and involves consequences of greater importance to the art, I shall be induced to deviate from my original design, in attempting to explain the principle on which it operates, that scientific men as well as the mere artist may form an opinion on the subject. I do not presume to suppose that the theory I shall offer will be perfectly correct, or will include all its ramifications. If I can give a clue that will enable other more scientific men to take up the subject, and elucidate it with their usual perspicuity, it will, I humbly hope, be themeans of throwing some additional light on this intricate and mysterious art

I have said that the waters in the county of Gloucester, where they are more celebrated for dying black, than in any other part of England, holds carbonate of lime in solution. After the cloth has been boiled with the dying wares, two or three hours for black, sulphate of iron and sulphate of copper are added, for the purpose of saddening the colour, as soon as these are thrown into the liquor there, a violent effervescence is produced: the carbonic acid gas is separated from the carbonate of lime, by the lime combining with the acids of the salts, and there remains in the liquor a sulphate of lime, an oxid of iron and copper, a sulphate of iron and a sulphate of copper. When colours are done in water containing

no lime, nor any other carbonated alkaline earth, the salts in the liquor will remain in solution in the same compounds as before they were added to it. In the one liquor then, we shall have in solution

Sulphate of iron, Sulphate of copper, Sulphate of lime, Oxid of iron and copper,	in the other only.	Sulphate of iron, Sulphate of copper.

Every chemist must know that a material difference in the colour will be the result of these two compounds. The sulphate of lime in the first will raise the blue of the logwood, and thereby increase the body and intensity of the colour on the goods dyed. I have made two or three attempts to substitute caustic, and sub-carbonated lime-water, in place of the natural; having previously inferred that a similar effect would be produced by it. I found it raised the colour of the logwood, yet for want of sufficient experience in its use to fix a proper standard, I have never been able, successfully, to imitate the natural water. I have discovered, however, that when too much was used, it had an injurious effect, making the logwood tincture of a pale Prussian blue colour.

The most important inference to be drawn from these facts, is, that dyers ought never to expect that receipts, obtained from other countries, or from other parts of their own, should produce exactly the same colours when used by them, as they have done with others. And also, that for dyers to become eminent, they must be stationary, they must continue to practise in one situation, and with one kind of water, that by these means alone, can they be able to obtain perfection in the art. It is, nevertheless, useful to become acquainted with the practice of others, and more particularly with the science of chemistry, on which the art is founded; but they must not implicitly rely on any thing but their own practise. It further proves, that dyers who are continually roving, will have partly to learn their business over again at every new place.

The difference in the effects produced, between dying from any

receipt in one place and in another, may, and do often arise from other causes beside the variableness of the water; see scouring wool, cloth, &c.

I hope what I have advanced on this subject, will be sufficient to convince those who may be interested, that almost any water is calculated for dying, provided the supply be regular, and always in the same state; and that water, however soft, that is subject to alterations from season and rain, or any other cause, is not fit for the purpose.

ON THE BAD EFFECT ARISING FROM THE ITINERANCY OF THE DYERS.

THE itinerant habits of the dyers of this country, is much against their arriving at any considerable degree of perfection. In fact, the manner in which it is carried on at the factories, is altogether highly detrimental to the progress of the art, injurious to the interest of the manufacturer, and in a great measure, the cause of the itinerancy of the workmen. Perfection in dying, is only to be obtained by local practice. When a dyer remains in one situation where he can obtain such dye-wares as he may want, prepared uniformly in the same way, and where the water is always in the same state, he will gradually acquire the art of producing new colours, and new shades of colour; and will attain a precision in making them, which an itinerant never can equal.

In England, the colouring is generally performed by public dyers, who attend personally to the business: they employ foremen as managers, who are usually taken from among the common workmen. When the owner of a dying establishment perceives in any of his men a more than ordinary capacity, and at the same time, approves of his general conduct, he will propose, if he wants a foreman, to instruct him in the business. When this is mutually

agreed upon, the man is bound for a term of years, say fifty, or sixty, on conditions subject to a heavy penalty, to serve his employer faithfully during the stipulated period, and never to make known to any other person the secrets communicated to him, or which he may attain during his practice. As a compensation for losing his liberty, he generally has double wages secured to him, and this is mostly advanced as his services become valuable. These dying establishments are usually situated near the centre of a manufacturing district, and is an heir-loom in the family, being conveyed from father to son for several generations. The business gradually progresses in extent and perfection far beyond what may be conceived of in this country. When wool or cloth is sent to a public dyer, patterns are sent with it, and it must be coloured so exactly, that when finished, the manufacturer cannot perceive the least shade of difference between it and the patterns sent. It often happens that more than one hundred patterns will be received in one day, all varying in colour; and it may readily be supposed that a dyer who can at one glance arrange, and afterwards colour them exactly to pattern, must have attained considerable perfection in the business.

My object in mentioning these facts, is not merely to show what the dyers are capable of doing in England; but to prove that the manner in which it is generally carried on in this country, has a tendency to retard the progress of the art.

Every woollen manufacturer here, whether small or large, employs a boss dyer. These seldom remain in the same situation more than one or two years, and more frequently a much shorter period. This year they will be employed in the district of Maine, or state of Mass. the next in Ohio, or Kentucky; in some places they succeed to the extent of their judgment, in others not; but they all profess to be very knowing in their business, and those just out of their apprenticeship, having served one year, profess to know the most. This is not the way by which perfection in the art is to be obtained, nor could the best Enropean dyer, under the

same circumstances, do any better than the mere novice, probably not so well, for in each factory, he would have to contend with a mass of difficulties quite foreign to him; the dying wares would be of different kinds, and in different states of preparation; the woad, he had to colour blue, would be in a different state, and very inferior to what he has been accustomed to use; the lime employed would be either too weak or too strong; the wool would not be well scoured; the cloth would be sent to the dye-house full of grease; the furnaces would be badly set, so as not to boil when necessary, and the cloth, when coloured, would be scoured with urine or soap, instead of fullers' earth, and then, perhaps, not more than half scoured. All these, and many other impediments, he would have to contend with, and without the power to remedy the least evil. Should he complain, he is said not to understand his business; and what with taunts on the one hand, and real difficulties on the other, he resigns all pretensions to the business, and follows something else; or he gives into the common mode of the country, and settles down as a plain edge-dyer. This is no fanciful picture, for two or three such instances have come under my notice.

One of two things must take place before the art of dying can be brought to any considerable degree of perfection in this country. Either the managers must learn to be their own dyers, and devote their time and attention to it, or it must be done at a common dyehouse, where work shall be taken in as in England. The latter would certainly be the preferable plan, and to this it will sooner or later arrive. A public dyer could afford to do the work at a cheaper rate than it can be done in so many small establishments—he could do the work of one hundred manufacturies, and would be satisfied with a profit of five or six thousand dollars a year; and this will be found to be only a small portion of what is now paid by that number for boss workmen. Supposing each boss to receive only eight dollars a week, the aggregate paid by one hundred manufacturers will be upwards of forty thousand dollars per annum, and even in this one item they would, by em-

ploying a public dyer, make an annual saving of thirty-four thousand dollars. The same number of manufacturers would have to expend at least one hundred and fifty thousand dollars in the plant for dye houses, furnaces, vats, &c. which would be altogether saved by them. I do not pretend to assert that this system could be successfully adopted at the present time, as I cannot see where sufficient work could be collected from; but a few years will necessarily bring it about. And it is probable that if a dye house should even now be established, in a central situation, purposely for dying of wool and woollen cloth, with proper conveniences for scouring and washing, fulling, finishing &c. where the work could be executed in a perfect and masterly manner, with sufficient capital to contend against old prejudices; it would soon be felt to be a great relief to the manufacturer, and sufficient employment might be found to answer the purpose of the capitalist.

The more a business is divided, the better and cheaper it can be performed. In England the wool sorting, the dying, the list making and the weaving, are all distinct concerns, separate from the factories. The manufacturers know where to purchase the one ready prepared, and have the others well executed; but they have no capital to expend on those branches; they are not plagued by employing workmen in them; and they never feel any anxiety about the result: all that is necessary, is for them to have a good judgment in wool, and in the colours, and weaving. In this country every thing is performed within the walls of a factory, and a curious anomaly is thereby produced; for where there is the least capital, and almost a total want of judgment, there the greatest portion of cloth is required, and the managers are plagued with more branches, and a greater variety of workmen.

ON CLEANING CLOTH FOR DYING, AND THE WASHING OF WOOL AND CLEANING THE CLOTH AFTER DYING.

MANY of the minor operations in a factory, and in dying, which people who are not well versed in the business are apt to neglect, as being of little or no consequence, have an important bearing on the well being of the whole. Such are the operations I am now about to describe, and I am sorry to have occasion to observe that they are too generally neglected in this country. I have before remarked, and which cannot be too often repeated, that cleaning the wool and cloth well from all kind of extraneous matter previous to the dying, is a necessary preliminary to the production of good colours; and I must add, that to clean them well from the dye afterwads, is no less necessary: when in wool for the benefit of carding, spinning and weaving; and when in cloth for the credit of the colours.

When wool has been dyed, the light colours require only to be well washed in the swilling basket, the darker colours, and particularly blue, should be first washed as directed for the light ones, then soaked six hours, or more, in milk warm water, with as much oil of vitriol in it as will give to the liquor a slightly sour taste, and then it requires a second washing. Many dyers and manufacturers will be ready to say this is a troublesome and expensive operation; I grant it; but were they once to try it, and have it done faithfully, they would find this trouble and expense more than trebly compensated for in the subsequent operations. The wool would not require so much oil, it would card and spin better, would not be so liable to break in weaving, and the cloth would be worth five per cent. more when finished.

All the colours given to cloth, may be cleaned by steaming, or beating with sticks, from a bridge over a running stream, excepting blue and black, which require to be scoured in a fulling mill.

Each of these operations I shall describe, for unless the dyer and manufacturer have conveniences suitable to the well performance of an operation, or is ignorant of what is necessaroy to be performed, they cannot expect to have it successfully executed. I have been much surprised that in works written on the subject of dying, the process for cleaning white and coloured wool, and cloth, should be passed over as operations of no consequence. It proves what every practical artist must be well aware of, that a mere theoretical writer on the arts and manufactures, however splendid may be his literary talent, is not calculated to throw much light on the minutiae of these subjects, and we all know that it is a combination of little things that constitutes a whole.

The apparatus used for streaming, is a bridge six feet wide, and at least ten feet long, which is placed across a rapid stream, where the water is not less than eighteen inches deep. About sixteen feet below the bridge, a windlass is placed parallel with it, and elevated about sixteen inches above its level. At one end of the windlass, is fixed a pully, three inches thick, and one foot three inches diameter; around this, holes are bored to place in four or or five stout handles, which project twelve inches from the solid pully, and a boy works the windlass by means of these handles. The cloth, intended to be cleaned, is carried to the bridge on a slatted hand-barrow, called a scallet, and to the head end of the cloth is fastened, by means of a running noose, some large twine permanently secured at the other end to the centre of the windlass. The two men who carry the hand-barrow, having secured the twine on the cloth, throw the end to which it has been fastened, on the water, placing each a foot on the list next to him, whilst the boy strains that part between the windlass and the bridge so as to keep it fairly on the surface of the stream; the two men are prepared with each a long pole, large and smooth at the lower end, to prevent their damaging the cloth, with which they strike it, in rather a slanting direction, and keep so beating till the water runs clear from it; they then lift up their feet to let another length upon the water, and the boy continues to wind up,

always keeping it at a proper strain until the whole is off the hand-barrow. The cloth is then drawn back again. For dark colours, this operation is repeated two, three and even four times, or until the colour will not stain white paper. The men who work it, have wooden soles on their shoes an inch thick, the upper leathers being put on with tacks; but no iron or any other metal is permitted to be on the soles. They have also leather coverings to tie round their legs from their shoes to a little above their knees, to protect them from the splashings of the water. In this way all the colours, excepting blue and black, are cleaned, and so well are they done, that the darkest brown, or the blackest bottle green, will not stain the whitest linen. In towns where access cannot be had to streams of water, they fill backs with water from pipes, and beat and rinse the cloth in it; but this is not so effectual as the plan I have described.

Blue and black cloth is also streamed before it is taken to the fulling-mill, but never on the same bridge where other colours are worked. They are then taken to the fulling-mill and washed under the hammers, until the water runs clear from them, when they are taken out of the stocks, and hung up on long, large wooden pegs placed in the walls of the mill-house for the purpose, where they are left to drain till the day following. They are then taken down, spread open, and wet fullers' earth thrown on all over the face; the lists are now thrown together, and they are carefully placed in the fulling-mill, which is plugged up, and the hammers let down, and permitted to play on the cloth, without water, for half an hour, or forty minutes. The cloth is then handed out, the lists pulled square, the earth spread even on the cloth, and more earth added, if necessary. The cloth is then put again into the stocks, and the hammers suffered to play upon it one hour; after which, a small quantity of water is let run into the stocks, not more than would pass through a large wheaten straw, for half an hour, in order that the earth may be diluted slowly, and by degrees. After that, the cloth is once more handed out, the lists pulled square, then put again into the stocks, and the plug pulled

out, when a full stream of water is introduced till it be perfectly clean. During the last operation, it is to be, from time to time, handed out in order to prevent its taking a wrong position in the stocks, and being torn. It is better after the cloth has been finished with earth and diluted by admitting the small stream of water, to take it out of the fallers and put it into a poacher, where it may be washed without any fear of damage. This may be done in all washings.

The water that comes out of the stocks, shows whether the cloth is clear, for that which runs out, should be equally as clear as that which runs in. If on trying the cloth you perceive it still soils, it must be worked with earth a second time. River or clear rain water is the best to mix with the earth, and hard water for washing it out.

To prepare cloth for dying, it must be worked with earth, as before directed, only when it has gone the first half hour in the stocks a small stream of water is let run in for half an hour, and then a full stream until it be quite clean. The handings out must be observed as before directed.

Many people colour their blacks after fulling, without scouring with earth; but the colours will not be so good, nor will they clean so well afterwards, because there will always remain a portion of soap in the cloth, which washing with mere water will not detach from it, and when this comes into the black liquor, or any other dye, the soap will be decomposed, the soda will combine with the acids, and the grease being liberated, will produce an effect equal to the colouring of greasy cloth.

Some few dyers there are, who scour with urine, previous to dying, which they imagine gives a softness to the cloth and improves the colour. For the advantage of those who wish to try it, I shall describe this process, although I have never been able to discover any sensible difference.

SCOURING WITH URINE PREVIOUS TO DYING.

AT the time you fold the cloth into the stocks, pour as much urine upon it as is necessary to wet it, and cause it to turn; the hammers are then suffered to play for half an hour, after which the cloth is handed out, and its lists pulled square. The handing out has also for its object to spread the urine even on the cloth, and some added on places, if any there are, where urine has not penetrated. It is put again into the stocks, and worked for another half an hour; a small stream of water is then introduced into the stocks during forty minutes, when the water is let in freely till it is perfectly clean.

When cloth is dyed in the flannel, before fulling and after burling, it has to be cleaned with earth or urine, as directed for fulled cloth.

Another method of scouring blacks, known only to a few manufacturers and dyers. It is the process pursued by the celebrated Edward Shepard, Esqr.

First wash out the gross filth, then scour with earth as before directed; after which hand them out of the stocks, pull the lists square, and spread on each piece of forty yards, one pound of dissolved castile soap, with a sufficient quantity of fuller's earth, put it again into the stocks, and let the hammers play on it for one hour, then proceed, as before mentioned, and wash them clean. It has now to be taken out of the stocks and moued two courses, (that is, twelve runnings up at the gig-mill ith dead work) then returned into the stocks and washed with a full supply of water till clean; in this last operation, a great discharge of colour takes place, which the mosing appears to have liberated. Then give them another course at the gig-mill, when they will be quite clean and very soft.

It is to be observed, that castile soap is preferable to any other for, being made of olive oil, it imparts a softness to the cloth whic soap made with common fat never can give. The best manufac-

turers in the west of England use none but this soap for fulling, or for any other process about their cloth. It is made by Fry of Bristol, and is sold at one shilling sterling, or twenty-two cents of this currency per pound.

Bullocks gall is occasionally used to clean blacks, when, from any cause, such as the grease not being cleaned out in the braying, the colours do not score well in the usual way.

ON THE MORDANTS AND DYING DRUGS USED BY THE DYERS IN ENGLAND, ON WOOL AND WOOLLEN CLOTH.

THE mordants used there are allum, cream, and crude tartar, blue vitriol, verdigris, copperas, tin liquors, and occasionally the acids. I shall include the mixture of oil of vitriol and indigo, commonly known by the name of chemick, although it does not properly belong to the class of mordants.

Moodants are used to fix the colouring matter on the goods dyed, and unless these are employed with discretion the colours will not, (with some few exceptions) be permanent.

A much greater portion of mordant is used in dying of cloth than in colouring of wool; for if the same quantity were used on wool, it would, in the greater number of colours, render it unfit for spinning, weaving, and fulling.

Allum is used more generally, and in much greater quantity, than any other mordant, yet no other salt has so great a tendency to render the wool harsh and unfit for working. It is to soften the effect of the allum, to give additional stability to the colour, as well as to brighten and change the hue given by the dying wares that cream of tartar and argol are used. To the want of employing

these salts more generally in this country, is to be attributed their principal deficiency in the production of furnace colour.

Every dyer is well acquainted with cream of tartar. It is the crude tartar in a purified state, which is too expensive to be employed by the dyer in any other than high priced, delicate and bright colours, such as scarlets, auroras, oranges, buffs, &c. &c.

As argol or crude tartar is very little known in this country, it will be necessary to describe it. It is the lees of wine in its natural and unpurified state, from which cream of tartar is made: but this last is much too dear to be used in common colours, nor does it always answer so good a purpose, for argol, independent of its operation as a mordant, produces a light brown colour from the colouring matter of the wine lees, therefore it is always preferred for dark colours, such as bottle greens, dark browns, blacks, &c. &c. There is a great range in the quality and value of this article, the lowest being strongly coloured, having a dirty looking appearance, and is in a semi-pulverulent form, whilst the best is in semi-transparent crystals, of a light colour, and so hard as to require the force of a hammer to break them. The latter, when prime, is worth nearly as much as purified cream of tartar, and the lowest quality, not more than one fourth the price: the value of intermediate samples will be as their quality. That which is used for the greater number of colours, is of a middling quality, and when the lowest are used, it is particularly mentioned in the receipts.

When the crystals of blue vitriol have the least tinge of green, they are not good, as they then contain more or less of iron, and approximate to a mixture of iron and copper salts, instead of being entirely of copper. This salt, when prime, should be of a rich blue colour, the crystals large and dry.

Verdigris should be light in weight for its bulk, and should be of a light blue colour. The French verdigris is considered the best.

Copperas varies very much in quality, some being small and rusty, and others being in large crystals and of a fine green colour. For dying of black the small rusty copperas is preferred, for drabs and other light colours, that which is in large crystals and of a bright green is employed.

TO MAKE TIN LIQUOR FOR SCARLET AND OTHER COLOURS.

THE best aqua-fortis, and that which is generally used in England, is made by S. Key & Son of Bewdley, and by Randall of London, that which is made by the latter being now mostly employed in the west of England, and it is always what is called single aqua-fortis. A Mr. Innes, formerly of Bristol in England, now a merchant in the city of New-York, was once a celebrated maker of this article. It will be understood, that out of the great number of makers in the west of England, and in London, only two or three are able to make an article fit for the scarlet dyer, therefore, it cannot be expected, that aqua-fortis, which is bought in this country, without knowing its strength or quality, should answer the purpose, or that the colours produced by it should be of uniform brilliancy.

The tin liquor is prepared in stone ware pots, larger at the mouth than at the bottom, each one having a lip for the convenience of pouring out. The tin is always obtained from Cornwall in stamped blocks, and none other can be depended upon as being genuine. To obtain it pure is of the utmost consequence. That which is in bars is very liable to be adulterated, as it goes through the hands of some dealer in the article after it comes from the governmental assayer, who is bound not to let any block pass that is not pure tin, and it is too much the interest of the dealers to adulterate it, by mixing with it some cheaper and baser metal. The blocks weigh about three hundred pounds each, and when a dyer wishes to pur-

chase, he has samples sent him from several blocks. Each one of these are melted separately in an iron ladle, the samples are tried, and the best are purchased for use. To prepare the tin for use, it is melted in the ladle, and run into a tub of water: the ladle is elevated about ten feet above the tub, and the metal let out in a small stream, by which means the tin becomes separated into thin small porous pieces. The water is now drained off, as close as it can be poured, without permitting any of the tin to follow it. The tin is then taken out and put into a sieve to drain; when the water is all drained off, the metal is placed and spread on a smooth clean platform until dry; for tin must never be put into the acids in a moist state.

The stone pots, in which the preparation is made, hold from eight to ten quarts each, they are placed in an oblong reservoir, for a large concern, two feet by fifteen, and five inches deep; into this cold water is let run from a pipe during the whole of the operation, and the waste water passes off through an opening left at an heighth that will just preserve the pots from swimming, when the liquor is in them. Into each pot is put four pints of the single aqua-fortis, before described, two pints of water, and a handful of white blown salt, and each requires about eight ounces of granulated tin. The tin is supplied gradually, a small handful at a time being put into each pot, and they are kept constantly stirring, by a man who sits in front of the middle of the row. The stirring is done with a rod of basket willow, or of glass, and after the first handful of tin is added, the man is kept very busy until the whole of that quantity is in solution, then another handful is added, and so on, until the necessary quantity is dissolved. Dry white willow is used to stir with, because that wood imparts no colour to the compound. It is to be understood that the aqua-fortis must not be completely saturated with tin, it being necessary for making a perfect colour, that the acid should be in excess. It requires about eight hours to perform the operation, for the first three it has to be continually attended and briskly stirred, and sparingly supplied with tin to prevent a decomposition of the aqua-regia; but afterwards it will only be neces-

sary to stir it every quarter of an hour, taking care to give it a good stirring whenever tin is added.

The plan recommended by some theoretical writers, of being two or three days in making this preparation, is highly absurd; for that which is made one day is always used the next, and if any remain unconsumed, it is employed for buffs, reds, crimsons, purples and other colours, being considered as unfit for scarlet; and the third day, a decomposition commences, if the liquor be exposed to the atmosphere, the tin being precipitated in the state of a mucilaginous white oxid; so that the preparation would be injured, and the solution rendered unfit for the purpose before it could be used, by being conducted so slow. The principal points to be attended to are, to have aqua-fortis as free as possible from iron; to make it weak enough before tin is added, to use none but very white clean salt, and not to permit too great a heat to be raised while the tin is dissolving.

In France they add to the aqua-fortis, previous to adding the tin, some sal-ammoniac in place of the salt, which practice is also followed by some of the English dyers; but if this be added to the least excess, the colours will incline to a pink.

In place of salt, the dyers often put in a small quantity of the spirit of salt, which preserves the yellow of the colour, but is not considered as good as salt by the best scarlet dyers.

Spirit of salt is often prepared separately, and the liquor added to the other tin liquor afterwards. When spirits of salt is prepared by itself, a large quantity of tin is put in, which remains three or four weeks before it is dissolved, being stirred only occasionally.

NEW MODE OF PREPARING LIQUOR FOR SCARLET.

I HAVE been convinced since the year 1807, that the tartaric acid, or that acid which is a component part of cream of tartar, is the only material in the complicated compound of acids and salts used in the scarlet process, producing that effect on cochineal which occasions it to change from crimson, its natural colour, to the vivid orange that constitutes the scarlet: and this discovery was more the effect of chance than of preconceived deductions.

I was that year engaged in the laboratory of Mr. Wm. Bryan, Sen. (who was then an able and extensive dyer in London, and whose sons pursue the same business in New-York) in making experiments to discover the effects produced by the mordants on every kind of colouring matter. While so employed, I put into a phial of aqua-regia, as much pulverized cream of tartar as I had been accustomed to use in the dying furnace, with the same portion of acids. The bottle was labelled, and laid by on a shelf. About two months afterwards, I was engaged in experimenting on the colouring matters producing yellow, when I used some of the mixture with the old fustic; the effect produced, surprised me very much, the colour being more brilliant than any I had ever seen produced from the same material; and it proved, after the most severe trials, to be as permanent as it was beautiful. On examining the list of patterns in April, 1821, I found every other yellow was faded, whilst that one had retained its original body and lustre.

In the year 1810, I made some experiments on cochineal, with the mixture; and the colour produced by it, was a fine scarlet, very brilliant and well grounded, and I found, on trial, that it stood the test of washing and exposure to atmospheric changes much better than any scarlet dyed after the common mode.

The longer the cream of tartar remains in the aqua-regia, the more completely will any given portion of the compound, yellow

the cochineal; and when the mixture has been standing three or four months, a very small portion of it is sufficient to produce the scarlet. This fact proves that the decomposition of the super-tartrite of potash (cream of tartar) goes on very slowly, and that it is the tartaric acid alone, which produces the effect of oranging the cochineal. It would require a number of nice experiments, and considerable time to ascertain the exact proportions of the different ingredients to produce the best mixture, with given quantities of acids, tartar, and cochineal. If I had capital to spare, I would willingly devote my time to bring this process to perfection.

TO MIX OIL OF VITRIOL AND INDIGO TO MAKE CHEMICK.

THIS mixture is made in glass or stoneware pots, having lips for the conveniency of pouring out. Common earthenware will not answer the purpose, it being glazed with a preparation of lead, and the vitriol acting on it, dissolves the lead very much to the injury of the colours made with the compound. When the glazing is gone, which it will be in a very short time, the clay will absorb the mixture and permit the compound to leak through it. The pot into which the mixture is to be made, is put into a sand heat that may be fixed in any iron pot of sufficient capacity for the operation. First obtain an iron pot large enough to hold the stone one, for one half of its depth, and to permit three or four inches of sand to lay below the bottom, and around it. The pot is set in brick work, with a grate under it, the fire not being permitted to reach higher than the sand inside. The sand employed, should be tolerably fine, and of that kind which is called silicious, such as is used by glass makers. The oil of vitriol should be of the strongest kind, that which has the greatest specific gravity, and is perfectly pellucid.

Oil of vitriol was formerly made by burning sulphur with a giv-

en portion of salt-petre, on carriages covered with lead, in large close rooms lined with lead, and the sulphuric gas was condensed in a cistern of water at the bottom of the room. The liquor was afterwards evaporated in leaden vessels to a given strength, and then rectified in large glass retorts. Within a few years, a patent has been obtained for making it in a more direct way. I have never seen this in operation, but have been informed that it is done by bringing together two streams of gas, one of oxygen, another of sulphureous, which by some refrigeratory process, are made to combine, and that the result is the production of a strong sulphuric acid (oil of vitriol) in a more direct way than by the old process. However that may be, this oil of vitriol is very much superior to that which is made after the old mode; its specific gravity is greater, and it dissolves indigo more completely. My brother uses it altogether, and he has informed me, that he would not take the other, to be compelled to use it, as a gift. I am informed that this new vitriol is sold at two pence three farthings the pound, and is manufactured either at Manchester, or Liverpool, I do not remember which. It is important that those who use chemick for blue and green, should be supplied with this article.

When the best oil of vitriol is procured, the next thing necessary is to obtain such indigo as is suitable to mix with it. A fine, light, compact, purple indigo, either of Spanish or Bengal, should be obtained; but it not unfrequently happens, that the best looking indigo is unfit for the purpose, and this can only be known by a direct trial. It is customary, therefore, to obtain small samples from several lots, and to try them with vitriol before making a purchase. The trials are made in small pots, into each of which, eight ounces of vitriol is put, and the pots are placed in a bucket of hot water. When the vitriol has become warm, there is stirred in each pot, two ounces from each sample, in a state of fine powder, by small quantities at a time. That which is the best, is known by its rising moderately as the mixing progresses, but not too much, for when the effervescence is too strong, a portion of the indigo will be decomposed, and when very rapid, the whole; and that which is de-

composed, will not produce any colour, nor will it mix with either cold, or hot water, for the indigo appears to be completely carbonized. When it does not rise at all, the mixture is incomplete, that is, the indigo is not properly in solution, the goods dyed with it, will be uneven, and the colour very fugitive.

When such vitriol and indigo are procured as will make a complete solution, the pot is put into the sand heat, with four pounds of vitriol for every pound of indigo intended to be dissolved. The indigo must be ground very fine, in a dry state, in a steel mill, or by pounding and sifting through a fine sieve. A fire is made under the sand pot, and driven till the vitriol is of the temperature of new milk, when the fire is lowered so as to keep it at that heat. When the vitriol is warm enough, a small tea-cup full, or rather less, is put in, and stirred until well mixed, and such quantities are continued to be added, from time to time, as fast as they are dissolved, until all the indigo is in solution, after which it is kept constantly stirred for one hour, as well as during the operation. It takes about four hours to prepare twenty pounds of chemick, that is, sixteen pounds of vitriol and four of indigo. It has now to be covered down, and may be used the day following. After all these pains, which are necessary to make the article perfect, it will not be fit for use for more than two or three days, if left exposed to the atmosphere, but if put into glass bottles, with ground glass stoppers, the day after it has been made, it will keep good for months.

There are many receipts circulating, in this, as well as in other countries, for compounding indigo and vitriol for woollen dying. In some, five parts of vitriol is recommended for one of indigo, in others six, seven, and some go as far as eight; but when the vitriol is of a proper strength, four pounds will dissolve one of indigo as completely as any greater proportion, and it is worse than useless to employ more than is sufficient, for in all cases the action of the vitriol is injurious to the goods dyed.

We will proceed to describe those materials from which colour is

obtained. There are many dye wares used in England and in France, that have not yet found their way to this country. Such are Barwood, Green Ebony, Dyer's Weed, Weld and Brazil Wood. The four first of these are more generally used in Europe than any others, and it appears very strange to an English dyer to find they are here almost totally unknown. I shall commence by describing the most expensive dye drugs, such as cochineal, turmeric, colouring matter of shell lac, Brazil wood, madder, man-geet, and indigo.

ON COCHINEAL.

There is so much difference in the quality and value of cochineal, that it is impossible to describe it accurately, and nothing but practice in comparing samples, and in the use of it, can give that critical judgment, which will enable the dyer to make choice of those that are the best suited for the purpose. That which is called sylvester, having a white down covering the outside, is never used by the best scarlet dyers, the large black grained cochineal being always employed by them. Cochineal, being a costly article, is subject to great adulterations; there is often found in it a gummy looking substance, having no colour, sometimes stones are found in it as large as the fly. Every sample, before purchasing, should be scrupulously examined, and all suspicious substances separated from the real fly and broken, which will disclose the imposition, and enable the consumer to judge of the adulterated per centage. It is usual, when different samples are offered, after the adulterations are ascertained, to reduce each one separately into a fine powder, and to form a judgment of their relative value by their comparative shades of intensity. When dyers are compelled to purchase the sylvester, which is often the case from the scarcity of the black grain, they always make choice of that kind which is in the largest grains, and having the least white down on them.

Cochineal is ground in a mill kept expressly for the purpose, and is never permitted to be used for any thing else.

For the finest scarlet intended to be very rich in colour and body, no colouring matter should be used, excepting cochineal: but in general the manufacturer will not go to that expense, therefore, some yellow has almost always been used to assist the body of the colour: such as young fustic, black oak bark, and turmeric. The latter is what my father has always employed, and although it is not so permanent as black oak bark, yet it gives a much richer colour, making the scarlet more flaming: and as the yellow constitutes but a small portion of the body of the colour, it will not fade much, and has never been found fault with by military officers, who are the principal consumers. When scarlet cloaks were generally worn, I have seen the colour look very well, when dyed with turmeric, after having been used several winters; consequently, the colour cannot be so fugitive, as has been represented by many interested writers. Mr. Haight has informed me that scarlets, dyed with turmeric, will fade very much on drying before a fire; this may probably be the reason why they are always tentered in the fields, and never by a fire heat in drying stoves.

Turmeric is brought from tropical countries, it is in the form of bulbous roots, and, when broken by the hammer, should be of a fine golden yellow. If the roots are new, and have not been too much exposed, the outside will have a yellow appearance; but if old, they will be of a dirty drab; and the value of the drug will be in proportion to the distance this abstraction of colour has penetrated the root.

The colouring matter of shell-lac has not been known as a dye more than twenty years. It is imported from the East Indies in square cakes, and is sold by the company at from three to nine shillings sterling the pound. It is used for dying scarlet in place of cochineal, by a different process, which will be described when receipts for that colour are given.

Brazil wood is imported from the Brazils. It is the property of the crown, and every piece has the king's stamp on it. It has been

very scarce in Europe of late years, being sold there at seventy dollars per hundred in the log. It is used principally for colouring crimson and other colours of that hue. It is also the principal ingredient for making red ink.

Madder is imported from the Archipelago and Holland, the fine Smyrna being considered the best. Of madder there are four distinct grades, the crop, the umbro, the gamene, and the mull, and in each of these there are different shades of quality. The umbro and gamene are mostly used in England, for all common colours, and for the blue vats; the crop is used for fine reds, and the mull for very dark bottle green, for dark brown, and for some dirty drabs. That which is generally sold in America are either very inferior crops or first quality umbro. I have never seen any prime crop in this market, nor any of the inferior quality, excepting a sample of very poor mull.

Madder grows well in the western country, and I am informed it thrives in all parts of the United States where it has been planted. Many farmers in Kentucky raise it for sale, and I have seen some sold in the stalk there, that has been of a very superior quality. The mode of raising it is, by putting down a layer of roots in small beds, and covering them with a few inches of soil; these throw up shoots full of joints, which are laid down and covered with soil twice in each summer; these become madder, and throw up fresh shoots. In four or five years the whole bed is taken up for use, and the smallest roots replanted to make fresh beds. The product is very valuable, and well worth the attention of the manufacturer, as what could be raised on one acre of land would amply supply the most extensive manufacture in the country, for every purpose, after the first crop came round.

Madder is dried in stoves, or in the shade, when exposed to dry in the air, it is then ground and passed through sieves, by which the different qualities are separated. When sifted, it is packed

hard in tight casks, where the fine qualities become so compact, as to require a chisel and hammer to separate it.

M. D'Ambourney made many experiments upon madder, and he has given it as his opinion, that the fresh root may be used with as much advantage as that which has been dried and powdered; allowing four pounds for one; before using, it should be bruised in a mill, similar to that in which apples are ground; or the common, conical, iron bark mill would be preferable. Any person who raises madder either for sale, or for their own use, must wash the roots as soon as they are taken out of the ground, and dry them in the shade, or in stoves, as soon afterwards as possible; when dry it must, either ground, or unground, be packed in close casks, and headed down; for exposure to the air ferments madder, and destroys all its colouring matter. Many persons, as well dealers in the article, as consumers, not being aware of this property in madder, expose the surface to the air without any covering, by which it gradually becomes yellow, then assumes a dirty light brown, and is more or less damaged, according to the length of time it has been exposed, and to the moisture of the room in which it has been placed.

The outside of casks of madder, are always more or less damaged, and when sold in Europe an allowance is made for what is called crust. The injury a cask has sustained, is discovered by boring in from the bilge to the middle and drawing out the borer full of madder; by examining this, an estimate is formed of the average loss. Supposing a cask of crop madder of three feet diameter is offered for sale, having a damaged crust of two inches, the person who buys for use, without an allowance, will be a loser of nearly twenty per cent.

Most of those who work blue vats here, are under an impression that madder by giving out its red dye to the liquor, produces with the blue a rich purple blue colour; but in this they are mistaken; for madder immediately it is put into the vat, ferments, and in one or

two hours loses all its colour ; so that those who use the best crop madder under this impresssion, are contributing to the expense of the dye without reaping any equivalent.

Mangeet is imported from the eastern continent, in casks and oblong boxes. It is in long roots of the size of a pipe stem, and the colour it affords is similar to that given by madder, excepting it being rather more on the red. I am inclined to believe from experiments made many years since, that mangeet would be an excellent succedaneum for the yellows used with cochineal in colouring of scarlet.

In making choice of indigo, the dyer should attend to its weight, bulk for bulk, to its fracture and colour. That which weighs the least for its bulk, is smooth in the fracture, and appears of a fine purple or copper bronze hue, and when rubbed with the nail has a polished copper appearance, is the best. The qualities in this drug are so unlimited, that it requires great practical skill to make purchase of the most profitable article where the samples are nearly alike. The best way of ascertaining the relative value of samples, is to pound them fine, and to make choice of that which has the richest colour.

The indigo that is used in a fermenting vat, should be ground to a fine paste in water. This may be effected either in a cast iron pot, with balls turned by a crank, or with a mill, such as is used to grind printer's ink. The indigo should be previously soaked, by putting it into a tub, and filling up so as to cover it with boiling water. When this has remained soaking for three or four days, the indigo will become so soft as to crumble when moved, or when handled, will break by the slightest pressure of the fingers.

The ball mill I need not describe, as every dyer is acquainted with it: the shape of the mill in general use here is very bad: the bottom where the balls work, should swell, or belly out, and

the pot should narrow a little towards the top. A pot of this shape would never permit the indigo to be thrown out by the balls, when in motion, a defect very common in the bell shape pots used in this country. An indigo mill pot where more than one vat is intended to be employed, should be large enough to grind thirty pounds of indigo at one time, with two balls, each seventy pounds weight; these, if kept in constant motion, will completely grind that quantity in three days. The printers, or stone mill, must have an iron breaker through which the indigo may pass before it enters the stones; and the finer it is broken by this, the easier and better it will grind. A man is employed to lade in the soaked indigo, and about two hundred pounds may be ground in one day.

We have now gone through the most expensive dye wares, and shall proceed to take notice of the others, as logwood, camwood, redwood, peachwood, barwood, fustic, weld, dyer's weed, green ebony, young fustic, &c.

There are four kinds of logwood, the Campeachy, the St. Domingo, the Honduras and the Jamaica, known by the name of the places from whence they come. The Campeachy is the best, the St. Domingo the next best, and the Honduras the worst of the three. It is considered that three pounds of Campeachy is equal to three and a half of Domingo, and four of Honduras. The Jamaica, is a weak poor dye wood.

Camwood is not much used in the west of England. It was once employed there, but has been superseded by that of barwood, which is considered a much better wood for browns and other colours for which the former was used.

Redwood is but little employed, excepting in some peculiar colours, as will be seen by the receipts for dying. What is called redwood in this country, must be a different wood from that which goes by the same name in England; for redwood is there nearly

double the price of camwood. It is the same as is here called hatchwood.

Peachwood is the same as is here known by the name of nicaragua, it is rarely used, excepting in colours having a purple hue.

There are three qualities of fustic, the Cuba, the Honduras, and the Jamaica; the former is the best, and the others in succession, as they are named.

Weld is raised in France and England, from whence small quantities are occasionally imported into this country, and sold at seventy-five cents per pound This plant, (residæ leuteola) can be raised on any land that is not too rich, for on good land it runs too much to stalk, and produces a small quantity of colouring matter. It is a biennial plant, and is gathered when in full blossom, by pulling it up by the roots; it is then bound together in small bundles, and placed in the shade, in a favourable situation to dry. It will be necessary to procure the seed from Europe, as that which is obtained from the plants brought into this country, is not ripe enough for reproducing it, the plant being pulled while green, for the benefit of the dye.

Doctor Bancroft has taken much pains to prove that the quercitron, or black oak bark, will give a colour equally as good as the weld; but, English woollen dyers are convinced, after having tried the two, that the weld gives a more beautiful, and a more permanent colour, when used only with the common mordants, alum and tartar. There is another property in weld, which gives it a decided advantage over the black oak bark; it imparts a softness to all woollens coloured in it, which no other colouring matter does in the same degree.

Dyer's weed grows wild on commons, and around the borders of woodland, it has much the appearance of heath, and is known by the name wood wax. I brought some seed with me from England,

and planted a part of it on a mountain in New Jersey. If it should grow and increase there, I shall endeavour to extend the plantation.

Green ebony is imported from some islands in the Pacific; it is a green coloured wood, rather of an olive hue, and is much used in greens, olive browns and many other colours having a green hue.

Young fustic is the sticks, or woody part of the Venice sumac, and is sold cheap in England. The sap is white, whilst the inside is of a rich yellow. It is used in chips, and principally employed for oranges, auroras, &c. &c.

ON RAISING AND MAKING WOAD FOR THE BLUE VAT.

AS I consider the colour produced by the ash vat, to be in every way inferior to that from woad, I shall not attempt to give an account of it; besides I am not well versed in the ash dye, never having seen any until I came to this country. Those who want information on that mode of dying, may consult Doctor Cooper's work, where they will find an ample description of it. I am sorry to have to observe, that Mr. Cooper has committed himself very much in asserting that "the ash is the common vat for the blue dye employed in Europe," when it is a well-known fact, that in England, where three times as much blue wool is dyed, as in all other parts of Europe, this vat is totally unknown, not one woollen dyer in fifty having ever heard of it. And I understand it is only used on the continent by those who are ignorant of the woad dye.

In order to succeed well with this mode of dying, it will be necessary to obtain a regular supply of woad, and that it be always pretty nearly the same in quality and strength. To obtain this, it should be raised on strong good land, and always manufactured in

the same way; as any considerable variation will disappoint the dyer, and be the means of his producing colours more or less weak, as the wood is bad, or good.

As this plant and the mode of working it, is but little known in America, I shall give, in the first place, a copy of a letter from Mr. John Parish, to the Bath Agricultural Society, on the cultivation and manufacture of it, and afterwards describe the process I pursued to obtain a supply for the Providence Steam Factory during the late war, when English woad was selling at fifty cents per pound.

Mr. Parish informs us that this plant is cultivated in different parts of England, for the use of the dyers, as well as in France, Germany, &c. It is best to sow the seeds in the month of March, or early in April, if the season invite; but it requires a deep loamy soil, and is better still with a clay bottom, such as is not subject to become dry too quickly. It must never be flooded, but situated so as to drain its surface that it may not be poisoned by any water stagnating upon it.

If at any reasonable price, meadow land can be obtained to break the surface, it will be doubly productive. This land is generally most free from weeds and putrid matter, though sometimes it abounds with botts, grubs and snails. However, it saves much expense in weeding; and judicious management will get rid of these otherwise destructive vermin. A season of warm showers, not too dry, or too wet, gives the most regular crop, and produces the best woad.

If woad is sown on corn land, much expense generally attends hoeing and weeding; and here it will require strong manure, though on leys it is seldom much necessary, yet land cannot be too rich for woad. On rich land, dung should be avoided, particularly on leys, to avoid weeds. Some people sow it as grain, and harrow

it in, and afterwards hoe it as turnips, leaving plants at a distance, in proportion to the strength of the land; others sow it in ranks by a drill plough; and some dibble it in, putting three or four seeds in a hole, and these holes to be from twenty inches to two feet apart, according to the richness of the land; for good land, if room be given, will produce very luxuriant plants in good seasons; but if too nearly planted, so that air cannot circulate, they do not thrive so well. Attention to this, is necessary in every way of sowing it. Woad very often fails in its crop, from the land not being in condition, or from want of knowing how to destroy the botts, snails, wire-worms, &c. that so often prey upon and destroy it, as well as from inattention to weeding, &c. Crops fail also from being sown on land that is naturally too dry, and in a dry season; but as the roots take a perpendicular direction, and run deep, such land as I have described (with proper attention to my observations) will seldom fail of a crop; and if the season will admit of sowing early enough to have the plants strong before the hot and dry weather comes on, there will be almost a certainty of a great produce.

These plants are frequently destroyed in the germination by flies, or animalcules, and by grubs, snails, &c. as before observed: and in order to preserve them, the seeds may be steeped, with good success, in lime and soot, until they begin to vegetate; first throwing half a load or more of flour lime on the acre, and harrowing it in. Then plant the seeds as soon as they break the pod, taking care not to have more than one day's seed ready; for it is better to be too early, than to have their vegetation too strong before it is planted, lest they should receive injury; yet I have never observed any injury in mine from this, though I have often seen the the shoot strong. Either, harrows or rollers will close the holes. If the ground be moist, it will appear in a few days; but it will be safe, and a benefit to the land, to throw more lime on the surface, when, if showers invite snails and grubs to eat it, they will be destroyed, which I have several times found; particularly, when the leaves were two inches long, and in drills very thick and strong, but the ground was dry. When a warm rain fell, in less than two

hours, I found the ranks on one side attacked by these vermin, and eaten entirely off by a large black grub, thousands of which were on the leaves, and they cleared as they went, not going on until they had destroyed every leaf where they fixed. They had eaten six or seven ranks before I was called by one of my people to observe it. Having plenty of lime, I immediately ordered it in flour to be strewed along those ranks which were not begun. This destroyed them in vast numbers, and secured the remainder. Another time, having had two succeeding crops on four acres of land, I considered it imprudent to venture another. However, as the land after this appeared so rich and clean, I again ventured, but soon found my error. On examining the roots (for after it had begun to vegetate strong, it was observed to decay and wither) I found thousands of the wire-room at them, entwined in every root. I immediately strewed lime, four loads of six quarters each, on the four acres, and harrowed it in; when rain coming on soon after, washed it in, destroyed them all, and I had an excellent crop; but the side of the field sown first where they had begun, never quite recovered like the rest.

It is in vain to expect a good crop of woad, of a good quality, from poor and shallow land. The difference of produce and its value is so great, that no one of any experience will waste his labour and attention on such land, upon so uncertain a produce. Warm and moist seasons increase the quantity every where, but they can never give the principal which good land affords.

In very wet seasons, woad from poor land is of very little value. I once had occasion to purchase at such a time, and found there was no possibility of regulating my vats in their fermentation, and I was under the necessity of making every possible effort to obtain some that was the produce of a more congenial season. I succeeded at last, but I kept the other three or four years, when I found it more steady in its fermentation; but still it required a double quantity, and even then its effect was not like that from good woad.

The leaves of woad, on good land, and in a good season, grow very large and long, and when they are ripe, show near their end a brownish spot, while other parts of the leaves appear green, but just beginning to turn of a more yellowish shade; and they must be gathered, or they will be injured.

Woad is to be gathered from twice to four, and even five times in the season, as I once experienced, (it was an early and a late season) and for the next spring I saved an acre for seed, of which I had a fair crop. I picked the young seedling sprouts off the rest, and mixed with my first gathering of what was newly sown; this was very good. During one season I let these grow too long; the consequence was, that the fibrous parts became like so many sticks, and afforded no juices. When you design to plant woad on the same land the second season, it should, soon after your last gathering, before winter is finished, be ploughed; that is, as soon as the weather will permit, and in deep furrows or ridges, to expose and ameliorate it by the vegetative salts that exist in the atmosphere, and by frost and snow. This, in some seasons, has partly the effect of a change of produce, but if intended for wheat, the last gathering should not be later than September.

The land, after woad, is always clean, and the nature of the soil appears to be changed in favour of the wheat crop: for I have always experienced abundant increase of produce after woad, and observed that it held on for some time, if proper changes were attended to, and good husbandry.

Woad, when gathered, is carried to the mill and ground.

These mills grind and cut the leaves small, and then they are cast into heaps, where they ferment, and gain an adhesive consistence; they are then formed into balls, as compact as possible, and placed on hurdles, lying in a shed, one over the other, with room for air between, to receive from the atmosphere a principle which is said to improve them as a dye, as well as to dry them to

a degree proper for being fermented; but in summer these balls are apt to crack in drying, and become fly-blown, when thousands of a peculiar maggot generate, and eat, or destroy all that is useful to the dyer. Therefore, they require attention as soon as they are observed to crack, to look them all over well, close them again, so as to render them as compact and solid as possible; and if the maggot or worm has already generated, some fine flour lime strewed over it will destroy them, and be of much service in the fermentation. These balls, if properly preserved, will be very heavy; but if worm eaten, they will be very light and of little value. They are then to be replaced on the hurdles, and turned, not being suffered to touch each other; until a month or more after the whole that is intended for one fermenting couch, is gathered in, ground, and balled. And often not until the hot weather of summer is past, to render the offensive operation of turning it, when in the couch, less disagreeable, and not so apt to overheat, and, though temperature herein is necessary, yet a certain degree of heat must be attained, before it is in a proper condition for the dyer's use. This is easily distinguished by a change of smell, from that which is most putrid, and offensive, to one which is more agreeable and sweet, if I may be allowed the term; for few people at first, either can approve of the smell of woad, or a woad vat; though, when in condition, it became quite agreeable to those whose business it is to attend the vats. Woad is in this state of fermentation more or less time, according to the season, and the degree of heat it is suffered to attain, whether at an early period, or according to the opinion of those who attend the process; but the best woad is produced from a heat temperately brought forward in the couch, until at maturity, and turned, on every occasion necessary, which a proper degree of attention will soon discover.

The balls, when dry, are very hard and compact, and require to be broken with a mallet, and put into a heap, and watered to a due degree, only sufficient to promote fermentation, but too much moisture would retard it; and here is a crisis necessary to be attended to. When the couch has attained its due point, it is opened, spread,

and turned, until regularly cooled, and then it is considered in condition for sale; but the immediate use of woad, new from the couch, is not advised by dyers who are experienced; for new woad is not so regular in its fermentation in the blue vat. This is the common process. Woad oftentimes is spoiled herein, by people who know nothing of the principles of its dye, following only their accustomed process of preparing it; and hence the difference in its quality is as often seen, as it is in the real richness or poverty of its leaves, from the quality of the land. The process for preparing woad which I have followed, and which I consider beyond all comparison best, is as follows:

Gather the leaves, put them to dry, and turn them, so as not to let them heat, and so be reduced to a paste, which in fine weather children can do. In wet weather my method was to carry them to my stove, and when I had got a sufficient quantity dry, I proceeded to the couch, and there put them in a large heap, where, if not too dry, they soon began to ferment and heat. If too wet, they would not properly ferment, nor readily become in condition for the dyer. These leaves, not having been ground, nor placed in balls on the hurdles, their fermenting quality was more active, and required more attention, and also the application of lime occasionally, to regulate the process with the same kind of judgment as is used in the blue dying woad vat. When the heat increases too rapidly, turning is indispensibly necessary, and the application of very fine flour lime, regularly strewed over every laying of them; or, if the couch is getting too dry, lime water, instead of common water, applied by a watering pot, may have an equal effect, without loading the woad with the gross matter of the lime; though I conceive that the gross dry flour lime, and the oxygen of the air, will furnish* more carbonic acid gas to the woad, and retain such

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* The lime is dry slacked, and is used before it can have absorbed carbonic acid gas. Therefore, Mr. Parish must have been mistaken in the theory of this operation. The oxygen of the atmosphere combines with the colouring matter of woad while fermenting, and carbonic acid

principles as are essential to a better effect. For I have experienced, that woad which requires the most lime to preserve a temperate degree of fermentation, and takes the most time, is the best; so that at length it comes to that heat which is indispensible for the production of good woad.

In this couch it is always particularly necessary to secure the surface as soon as the leaves begin to be reduced to a paste, by rendering it as smooth as possible, and free from cracks. This prevents the escape of much carbonic acid gas, (which is furnished by the lime* and the fermentation,) and also preserves it from the flies, maggots, and worms, which often are seen in those parts where the heat is not so great, or the lime in sufficient quantity to destroy them. It is surprising to observe what a degree of heat they will bear. This attention to rendering the surface of the couch even and compact, is equally necessary in either process; and also to turning the woad exactly as a dung-heap, digging perpendicularly to the bottom. The couching house should have an even floor, of stone or brick, and the walls the same; and every part of the couch of woad, should be beaten with the shovel, and trodden, to render it as compact as possible.

The grower of woad, should erect a long shed in the centre of his land, facing the south, the ground lying on a descent, so as to admit the sun to the back part; and here the woad should be put down as gathered, and spread thin at one end, keeping children to turn it towards the other end; therefore it will be necessary to know how long the shed should be; but this can be erected as you gather, and then it will soon be known.

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gas is a product of fermentation; consequently, the lime, instead of supplying that gas, facilitates and regulates the operation, by combining with it.

* It is truly surprising how readily persons, otherwise correct, can produce theories so absurd. Unburnt lime stone is a carbonate, but when burnt, and fresh slacked, it does not afford carbonic acid gas; but will enter into combination with it very greedily.

Good woad, such as the richest land produces, if properly prepared, will be of a blackish green, and mouldy; and when small lumps are pulled asunder, the fracture and fibres are brown; and the more stringy they are, and the darker the external appearance, and greener the hue, the better the woad; but poor land produces it of a light brownish green. The fibres only serve to show that it has not suffered by putrifaction.

For the use of the dyer, the balls require a further preparation. They are beaten with wooden mallets, on a brick or stone floor, into a gross powder, which is heaped up in the middle of the room, to the height of four feet, a space being left for passing round the sides. The powder moistened with water, ferments, grows hot, and throws out a thick and fetid fume. It is shovelled backward and forward, and moistened every day for twelve days; after which it is stirred less frequently, without watering, and at length made into a heap for the dyer.

Such is the account which has been published of the manner of raising woad, and manufacturing the plant by Mr. Parish. I was well acquainted with Mr. P. he was an excellent dyer and made a great many experiments; and his process of making woad, was much spoken of by other dyers as being a great improvement. It serves to show that a considerable latitude may be observed in the process, without injuring the article; and this will be further proved in my own process, as follows:—

The land on which I raised woad in Providence, Rhode-Island, was none of the strongest, though it was in tolerable good condition, and I had it well manured. It was ploughed twice, and harrowed each time The seeds were planted in hills about three feet apart, five seeds in each hill; this was done as early as the season would permit, and it came up very fine, scarcely a seed failing. To facilitate the planting, I had a board cut four feet in length and nine inches wide; at one end I put in five short pegs, that projected two inches from the board on the underneath part, the pegs

being four inches apart. A handle was inserted in the middle of the board, of sufficient length to enable the person who worked with it to stand, upright; by this means he could walk over the ground measuring the distance as he went along, at the same time that he made the holes for the seeds, and this he was enabled to do as fast as two persons could plant them.

The wire worm destroyed a few of the plants at first, but these I soon got under, by looking after and killing them mornings, and by working in fresh slacked lime around those hills that had not been attacked. The plants were kept clean by hoeing, and they grew very rapidly. The first crop was ripe by the latter end of June, I had it gathered and spread on all the unoccupied floors of the factory, and on sheets out doors, where it lay, and was turned, until half dry, when it was conveyed to the dye-house, and there cut with sharpened spades in tubs, until it was sufficiently adhesive to work into balls; these were made with the hands, and were laid to dry on a large floor over the steam engine. In the early part of the drying, maggots, from fly-blows, were engendered in great numbers, and I was much troubled to keep them under; to effect this, I rolled them in fine, fresh dry slacked lime, and it never failed to destroy them. When I had dry balls enough, they were put in hogsheads, and pounded in as close as possible, and covered down. When a hogshead was filled, I had them closely covered, until the cool weather of autumn would permit their being fermented with safety, when all the crops were mixed together.

I had five crops off the land that season, and another in the following spring; for the plants grew very rapid after the first cropping, which were much increased by plentiful showers happening to fall immediately after each gathering. When the leaves are nearly ripe, a round ring will appear near their ends, and a purple spot in the interior of the ring; soon as these assume a brownish hue, the leaves must be gathered.

It must be observed, that I laboured under every disadvantage in manufacturing the woad, so as to make it fit for dying; the crops were good, and considering the quality of the land, and other impediments, it worked better than I had any reason to expect. Having made it myself, I was not restricted in the consumption, and I made up for the quality by using an additional quantity.

I have seen a good deal of woad raised and manufactured in England, and I am convinced, that where land of the first rate quality can be obtained, and proper attention be paid to cultivating and manufacturing, it may be raised and made in this country in the utmost perfection. It is an annual crop, well worth the attention of any enterprising American farmer, who has land of the quality wanted, and sufficient capital to erect sheds and machinery for working it. The mill used for grinding the leaves, is like the cider-mill that grinds with a rolling stone, or iron ring, in a circular trough, with this difference, that the woad-mill has knives following the roller, which cuts the plant as it moves round: this, with a shed, and a couching room, are all that is needed to commence the business.

The demand for woad will be improving as the manufactures increase; and those who have been using the ash vat, are changing for the woad dye, this also will increase the demand. There is none made in the country at the present time, in a regular way, so that any person who will undertake to establish the business, and make an uniform prime article, may calculate on its becoming an object of considerable magnitude, attended with a liberal remuneration.

ON THE WILD INDIGO PLANT AS A SUBSTITUE FOR WOAD.

THE wild indigo plant growing every where in this country,

ought to be brought into use for the blue dye. I gathered some in the fall of 1821, too late in the season to obtain it in maturity, and had it boiled, and used the liquor in place of swill from bran and madder, to assist the fermentation of the vats. The plants were too old to retain much of those succulent juices in which their value chiefly consist, yet they answered far beyond my expectation; for the liquors, so long as I was enabled to supply them with it, worked much more freely and more vigorously than in the usual way; and although this experiment was not decisive, for want of a sufficient quantity, and from the plant being too old when gathered, yet I am convinced, by the effect produced, that it might be used to considerable advantage. In Bancroft's first volume on permanent colours, this article is noticed as follows:

"It is well known, according to Mr. Clarkson, that the African dyers are superior to those of any other part of the globe.

"The blue is so much more beautiful and permanent, than that which is extracted from the same plant in other parts, that many have been led to doubt whether the African cloths brought into England were dyed with indigo or not. They apprehended, that the colours in these, must have proceeded from another weed, or have been an extraction from some of the woods which are celebrated for dying there. The matter, however, has been clearly ascertained: a gentleman procured two or three of the bales, which had been just prepared by the Africans for use: he brought them home, and upon examination, found them to be the leaves of indigo rolled up in a very simple state."

As this plant is found every where in the United States, and in many places in great abundance, it would be well to have some experiments made on it to test the superiority of the colour attributed to it; and if it should be found to possess the qualities ascribed to it, of which there appears to be but little room for doubt, it would become an object of great national importance, inasmuch, as the colour made from it would be superior to those ob-

tained from Europe, and thereby give to the American fabrics a preference in the blue dye, in which they are now decidedly deficient.

I apprehend these balls are made by simply placing the leaves together face ways as they are gathered; that when a ball is made, it ferments and exudes sufficient moister to cause an adhesion of the mass; and that this process developes the colouring matter, so as to enable the vat to extract it with sufficient facility.

The indigo made from the wild plant, is said to be of much better quality than that which is obtained from the cultivated; but that the former does not afford so great a quantity as the latter.

ON AMERICAN DYE DRUGS.

THERE are, no doubt, a great number of dying drugs in this country, which if known, might become valuable. It is much to be regretted, that some institution does not exist in this country to test and bring to notice its native colouring matters. In the hands of a practical and theoretical dyer, many valuable discoveries might be made of new dyes now lying dormant. Many of them might be used to advantage by the dyers of this country, and also become objects of some magnitude, as exports. It would require an appropriation of two or three thousand dollars per annum to effect the object, and I should apprehend, that five years would be sufficient to test all the colouring matters of the United States.

I am at present acquainted with only four native dye drugs, the sumac, the yellow bark, the bark of the swamp maple, and the alder bark. The two last not being generally used here, I shall describe their properties—of the first, I need say nothing more than that for colouring of black, or tanning morocco skins, it is not half so good as the Sicilian; particularly for blue blacks, as the Ame-

rican works much browner, and does not produce any thing like as much colour, weight for weight.

The alder is found plentifully in swampy places; it is generally of small growth, and has a motly nut-brown bark; the sticks are cut in the month of April, or the beginning of the month of May, according to the climate and seasons when the sap runs; the bark is stripped off soon as cut, (which is easily done by children,) and is dried in the shade, when it is fit for use. The poles make very good bean sticks, or excellent fire-wood. This bark, when the colouring matter is strong, produces a brownish drab with alum, and a light forest drab when only a small quantity is used. When employed in the black dye, it increases the body of the colour, even more than sumac, and is equally durable.

The bark of the swamp, or scarlet flowering maple, is said, by Doctor Bancroft, to possess all the good dying properties of nut-galls, with a less portion of extraneous precipitants. I have tried this bark, and am convinced of its being a valuable colouring matter, for the black dye, and for pearl drabs. Its extract gives a strong blackish purple with copperas, in body equal to that from nut-galls, and the colour looks brighter and clearer; but, like every thing else, it requires much experience to ascertain the quantity necessary to produce the best effect. I would strongly recommend the American dyers to bring it into use: let them first employ as much of it as of gall-nuts, and increase gradually, until they find what quantity will produce the best effect.

The saw-dust of the white oak, gives the best and most permanent body to blacks, of any material I have ever used, and is not so apt to turn brown, as sumac, oak bark, or any other material in common use. It requires about twelve pounds of oak saw-dust to twenty yards of broad-cloth, weighing twenty-four pounds, or half the weight of the cloth. The purple, given by the saw-dust, is finer than that which is obtained from nut-galls, or the swamp-maple bark, and is highly permanent. It is not improbable, that

the saw-dust of the swamp-maple, would be still better than that of the oak.

There is an acid in wood, called the pyroligneous, which is much used, when combined with iron, for dying and printing of black on cotton. It is highly probable, that when oak, or other saw-dust is boiled, this acid is extracted, and operates in producing the colour, in addition to the purple obtained as a colouring matter; for it is well known, that pyroligneate of iron, is the best mordant used in the black dye.

ON COVERING THE LISTS OF CLOTH WITH WEBBING TO PREVENT ITS TAKING COLOUR.

CLOTH, intended for scarlet, or any other cochineal colour, is always girt-webbed, to prevent the lists from taking the dye, as it would, being heavy and coarse, absorb much of the cochineal. This operation is performed with thick cotton, or linen webbing, which, being doubled to half its breadth, is then wide enough to enclose the list when rolled up. The webbing is put round the list, so as to enclose it all, and is sewn on with small twine, passing through the cloth close to the list, and drawn tight over both. The stitches are about one-fifth of an inch apart, when the list is covered, merely to save cochineal; but in other colours, when it is intended to deceive the purchasers, by making them believe the cloth has been wool-dyed, it is sewn on very close, and very even, no thread being permitted to enter the cloth, all of them passing through the last shoot of list next to it. Soon as a scarlet cloth is finished colouring, and has been partly cleaned by the streamers, it is put on a slatted scrave, that has been covered with a clean white cloth, and the girt-webbing is taken off. This is performed by women, who draw the threads out with hooks. After it is taken off, both the thread and webbing are well washed and hung up to dry for further use.

ON THE CHOICE OF VESSELS FOR COLOURING SCARLET, AND OTHER COLOURS, AND OF FURNACE-BASKETS AND REELS, &c.

SCARLETS may be coloured with safety, in vessels constructed either of brass, copper, or block-tin. When done in brass or copper vessels, they must be kept very clean, and the liquor must never be permitted to remain in the furnace after a day's colouring is finished. When a furnace is made of block-tin, it will have to be very stout, particularly at the bottom, and, when the fire is drawn, after a day's cooling, the liquor in the furnace will have to be cooled down, and the fire drawn some time before it is emptied, otherwise the bottom of the furnace will be liable to fall down and ruin it.

For dying of scarlet, and other bright and delicate colours, they have baskets made to fit the furnace, to prevent the goods from coming in contact with the metal and being soiled. They are used in England for almost every colour, excepting black. A basket is made to fit the interior of the furnace, and to project about two inches above the level of the top. They are made of willow, cut in the spring, and peeled by machines. The basket-maker, after having made the bottom, and filled in large willow rods all round it, places it in the furnace, and fills it up so as to fit it, making the top very stiff and strong. To the top of the basket, some clean white canvass is fastened, that reaches over the curb of the furnace, so that the cloth may never come in contact with the metal, or the curb.

The reel that is intended for scarlet, and for other bright and delicate colours, must be of white pine that is perfectly free from knots and other defects.

ON THE CONSTRUCTION OF VATS, FURNACES, &c. USED BY MANUFACTURERS AND DYERS, AND ON THE LAYING OFF OF DYE-HOUSES.

A DYE-HOUSE should be built of stone or brick, and the wall thick, to keep it warm during the winter, and cool in the summer. The roof should be high, with capacious air holes in it, over the furnaces, to let out the steam as fast as it rises. The part containing the blue vats should be separated by a partition, and the floor should be higher than the other, to prevent any of the liquor from the furnaces running among the blue wool. There should be room enough in the blue dye-house, to lay six or eight wets of wool without interfering with the workmen. Over each vat there should be one good light, nearly the width of the vat, and leaning a little forward towards the top, so as to throw the light more on the top of the liquor, than windows do that are made after the usual construction.

According to Mr. Cooper's account, a French blue vat is nine feet deep, by five and three quarters over. An English vat is seven feet six inches in depth, the same in diameter across the bottom, and six feet on the top, for wool dying, and five feet six inches, when intended to be employed exclusively for cloth. It is of very little consequence what depth a vat has, provided there be room enough to hold all the sediment collected during one working, so as it shall not interfere with the goods dyed. The English vat has in this respect a decided preference, as it will hold five hundred and sixty-one beer gallons more than the French; besides, a conical vat is much better than one that is cylindrical, for, after stirring, the sediment will settle more quickly, and will not be so liable to lodge against the rough sides; and the bottom, when settled, will be much deeper in the French than in the English vat, and consequently more troublesome to rake up, as well as to empty when worked down.

The American blue vats are many of them smaller at bottom than at top, a shape highly injurious to a woad vat, as I once experienced. When a flue is passed round a fire vat, it is necessary to keep the sediment as clear from the heated copper as possible, as it is very subject to be burnt, by which the contents of the vat are soon destroyed. This fact never came under my observation till lately, and, for want of experience in it, I lost two vat liquors, worth one hundred and seventy-five dollars.

White pine, clean from knots, two inches and a quarter thick, is used for making blue vats, and they are bound with stout iron hoops, about three inches wide, driven on very tight, the lower one over the chine, and a second about six inches above it; three others, making five in all, the last one near the top, are all that are necessary to make it very secure. When the vat is put in its place, a puddle of strong, stiff clay should be made under the bottom, on, and into which the vat is worked, until the space is quite filled up between the bottom of the staves and the bottom of the vat. To accomplish this, two or three holes are bored in through the bottom, to give vent to the air underneath, which would otherwise prevent the vat from sinking in the puddle.

There are three different ways of heating the vat liquors. One by turning it over into a furnace, and when heated to boiling, returning it again into the vat; a second, by having a part of the vat made of metal, and passing a flue round it; and thirdly, heating it by steam. I shall describe each of these operations, that those who are interested may make choice of either one which may please them the best.

When a vat liquor is bailed into another vessel to be heated, a furnace must be placed within a convenient distance, large enough to hold rather more than two-thirds of the liquor, without being quite full. Wide gutters must be provided, long enough to reach from the centre of the vat to the centre of the furnace, and a piggin holding two gallons suspended on the end of a long pole, will

be wanted, to lade the liquor backward and forward. A vat, kept in constant work with wool, will have to be heated twice a week; on Saturdays and Wednesdays. The liquor should be thrown over in the morning, after settling all night, before stirring, for if this be done an hour or two after stirring, there will be sufficient woad, and other contents of the vat floating in it, to burn against the sides and bottom of the copper; and, as indigo is always mixed with the sediment, some of this will also be burnt. When a liquor is in the furnace, the fire should be driven on rapidly, until it approaches to a boiling heat, and then lowered to prevent its boiling over, which it will do, as rapidly as new milk. A vat liquor, when strong in material, will boil at about 204° Fahrenheit, when weak at 208°. When near boiling, the head, on being separated by a board, will close together again instantly. Two buckets of water should be kept standing by the furnace, ready to throw in when the head begins to rise from boiling; the furnace door should be thrown open, and the fire raked out. After standing a few minutes, the liquor has to be thrown back again into the vat.

When a blue liquor is intended to be heated by fire, without bailing it into a furnace, the vat must be differently constructed. A wooden conical vessel must be first made, six feet deep, seven feet diameter at the bottom, and six feet on the top. This vessel is to be cut off two feet from the top, and a sheet of copper nailed on the lower edge of the upper piece, and the upper edge of the lower piece. The copper must be fastened on the inside, first working round the wood with a circular plane, three inches from each edge, and inserting two strips of canvass, well coated with white lead, between the wood-work and copper, on, and to which the latter should be fastened with copper nails, driven in so close that the heads come nearly in contact, but not so as to loosen them. A fire-place is fixed in any part of the circle that may be most convenient, with a grate, door-frame, &c. and is placed five or six inches lower than the copper round the vat. A brick flue is built round the copper, which commences where the fire enters, and continues to the other extreme of the circle, where the smoke enters

a chimney, and is conveyed off. The flue round a vat should be ten inches wide at the bottom, and three at the top, narrowing upwards, in order to facilitate the closing of it. There should be two thicknesses of brick between the flue and each edge of the woodwork, and a good layer of mortar between it and the first layer of bricks, to prevent the fire from charring the vat at either edge. It is better to leave a space of half an inch, or more, between the last course of bricks and the upper edge of the vat, so as to make it perfectly secure against fire.

I observed that the grating on which the fire is built, should be placed five or six inches lower than the bottom of the flue, round the vat. This is necessary to produce a draught; for, if the fire should be as high as the bottom of the flue, which is a dead level all the way round, it would be more likely to draw through the mouth of the fire-place, than round the vat. It would be still better, if circumstances will allow of it, to have the fire twelve or fourteen inches below the flue, by which the rapidity of the draught would be much increased. It is to be observed on the other hand, that the more rapid the draught, the greater is the liability of burning the contents of the vat; therefore, the greater caution is required not to put a fire round it till two or three hours after the vat has been stirred, when the sediment will be sufficiently settled to prevent any danger.

When a vat is heated by steam, it is cut off as in the former case; but instead of a sheet of copper between the wood work, a cylinder of iron is used three feet six inches deep, and the same diameter as the vat. It is cast with two flanges of seven inches, one near the top, and the other near the bottom of the cylinder. The iron extends a few inches at each end beyond the flanges, sufficiently to secure the wood work at the ends. The principal use of the flanges is, to insert a circle of stout staves between the two so as to secure a passage around the work and iron cylinder. Into this passage the steam is admitted from a boiler, and the condensed water passes off by means of a syphon, at any part of the

circle, where it may be most convenient to place it. The staves are fixed to that part of the iron which project beyond the flanges, and the vat is secured from leaking, by hoops outside, and by canvass coated with white lead on the inside. All this contrivance, which is troublesome and expensive, might be saved, if the steam could be admitted into the liquor of the vat; but this has been tried, and found to fill up by the condensing of the steam to overflowing.

As heating by steam is the best way of warming a blue vat, inasmuch as it is cheaper and more secure, it is probable that many who now heat them with fire, would make the alteration, if they could do it at a small expense. To do this, it is only necessary to make a flue round the metallic part of any vat so as to leave the space between the brick work and metal of only two inches. A small well must be left of three inches in the bottom of the flue, in which the short leg of a syphon is placed, the other leg lying outside, by which the water, when it collects inside so as to rise above the bend, will run off. The steam is let in about half way between the bottom and top of the flue through a tube of two inches diameter. The tube of the syphon need not be more than a quarter of an inch.

There is much difference of opinion with respect to the best mode of heating a blue vat, some prefer heating by steam, or fire in the vessel containing the liquor, but the greater number approve of bailing it into a furnace. Those who use the latter mode, ground their preference on the belief, that the indigo works more strongly, and produces more, and a better colour, after it has been thrown off the spring and partially oxydized by bailing, and a deoxydizement reproduced by a new fermentation; whilst those who work hot vats (as they are called, to distinguish them from the others) assert that the colour is injured by this too frequent a change from oxydizement to deoxydizement. I have worked both, and although the bailing be troublesome and expensive, and occasions some delay in the working, I cannot but give it the prefer-

ence; having always observed, that it worked more vigorously than the hot vat, and produced upon the whole, a finer and better colour. In working a fire vat, it is occasionally necessary to throw it over into a furnace and boil it. I am aware that this opinion is in direct opposition to the theory advanced by Doctor Bancroft and Mr. Berthollet; but whatever respect I may be inclined to pay to such high authorities, yet theory, however respectably supported, cannot be permitted to stand in competition with practical facts. It is often amusing to observe the extremes to which mere theoretical writers would lead the practical artist. I do not refer to either of the above named authors, their theory is always respectable, and never spun out into extreme applications; but an American author taking up the idea of a vat being injured by oxydizement, has recommended to have an opening in the cover that would just admit the rake, and a lid to shut down upon the opening, so that the vat need not be opened for stirring. He might as well have recommended us to cover the earth with canvass to promote the growth of the tribe of fungi, in order to pamper the appetite of an epicure in mushrooms; for as the earth, in that case, would be useless for the common purposes of life, so would a blue liquor that required such extreme caution, be useless for the purpose of dying.

The apparatus that is generally used in this country for taking the wool out of the vats, is a wretched substitute for the old English mode. They draw the wool, net, &c. out of the liquor by means of large pullies, and after draining some time, they squeeze it with a double lever fastened at one end by means of a chain. If any thing can have a tendency to injure the liquor by means of exposing it to the oxygen of the atmosphere, it must be this. In England the wool is taken out by means of a jack, kilt, trunch board, and trunch cloth, all of which are moveable, and can be applied to any number of vats in succession, one set doing the work of five or six vats. When every thing is properly constructed, the wool may be wrung so dry as not to damp the floor when laying in a heap. A sample of this plan of wringing wool, may be

seen at Mr. Israel Crane's factory, West-Bloomfield, New-Jersey, or if any person is desirous of employing them, I can have a set made to order; for I cannot give such written instructions as would be sufficient for a mechanic to make them accurately.

ON PREPARING OF WOODS FOR THE USE OF THE DYER.

IN England the dry-salters first rasp the wood from the log, and then grind it under two heavy stones, that revolves round and close to the perpendicular shaft by which they are worked; by this mode of working, the stones have a rubbing friction, independent of their weight, which facilitates the grinding.

I was, when a youth, on trial to the dry-salting business for three months, during the time of trial, I was entrusted with some of the secrets of the business, and among others became acquainted with their method of raising the colour of woods under the stones, when grinding. Every preparer of dye-wood, knows that it is necessary to make it damp when under the stones, to facilitate the grinding, which is mostly done with water in this country; but in England they damp their woods with a preparation previously made for that purpose, as follows:

An iron pot is two-thirds filled with water, to every gallon is added two pounds of the best crop madder; after this has been boiled two hours, pearl-ash is generally added, two ounces to each pound of madder; the liquor is then boiled for half an hour, after which it is permitted to cool down and the clear liquor taken off from the dregs. Should the water boil away too much, add it at discretion. Take the remaining dregs, add half a gallon, or more, of water for each pound of madder, boil one hour, and then add half the first named quantity of pearl-ash. With this tincture,

diluted with water, or genuine, the red woods are moistened as they are grinding under the stones. Logwood is moistened with urine and water.

The effect produced, is to raise the colour of the woods ; and it is said by those who practice it, that they will give out more colouring matter than when damped only with water : at all events the woods so prepared have a much richer appearance, than samples of similar woods have in this country.

As this is not yet done in America, it would be an additional reason to what has been offered before, why an European dyer cannot produce from his receipts exactly the same colour here as there.

ON DYING FURNACES, AND THE APPARATUS TO WORK THE CLOTH, &c.

BEFORE giving receipts for dying, it will be necessary to give directions how the cloth has to be prepared and worked, and the fires to be managed; for the goodness of a colour depends as much on regulating these things correctly, as it does on the materials used to produce it.

TO PREPARE THE GOODS DYED, AND THE MANNER OF PREPARING FURNACES, &c. FOR BLACK DYING, TOGETHER WITH ALL PRECAUTIONARY PREPARATIONS.

IN the first place, the cloth has to be well cleansed from all soap and grease, by scouring it with fuller's earth as directed under the head scouring of cloth, and also washing the earth out quite

clean. A corner at the head end of each cut is then put into a blue vat, having been previously wetted in hot water, and allowed to remain in till dark enough ; a portion of this being tied up with fine twine, will, when finished, leave a blue rose, and the other corner being tied up without dipping, will leave a white rose, such as are always seen in European blacks ; but the manufacturers of this country do not usually put roses in their black cloth, nor is there any necessity for it, excepting that which arises from the prejudice of purchasers. The intention of roses are to show that the cloth was not dyed any other colour before it was blacked, and that it was previously dyed blue, and though it is now well known that blacks are not woaded before dying, yet the practice is still preserved, and American manufactures would do well not to contend against an established prejudice.

The apparatus necessary to colour black, is first a large winch or reel with an iron bolt at one end, and a deep iron crank at the other ; this works on two uprights fixed in the circle, one on each and opposite sides of the furnace ; the winch should run on brass boxes, and be elevated for this colour as much above the liquor as it can be, without making the work too tiresome to the person who turns it. The object in thus elevating the winch, is to give an opportunity for the iron to oxydize as it passes through the atmosphere. I have known dyers have the reel placed seven or eight feet above the furnace, but I believe without any sensible advantage.

The furnace for black dying may be made, either of sheet iron, or copper, and should be large enough for the cloth to work in the liquor without being too much crowded ; on this circumstance will principally depend the regularity of the colour ; for when too much crowded, it is almost certain to be uneven. The bottom of the furnace should be turned up inside, so that the outside, on which the fire acts, may have the appearance of a dome. This has for its object to make the liquor boil with a less quantity of fuel, than when a flat or conical bottom is used, and also for the conveniency of

emptying the liquor, as this projection leaves a narrow ridge, that acts as a gutter, to carry the liquors to the vent hole. A dying furnace should, in all cases, when intended to be used for colouring of cloth, belly out at the centre, and draw in at the top; for when it is perpendicular, and more particularly when it widens towards the top, the liquor will boil out of the furnace, and endanger the safety of the workmen.

On the outside of the dye-house a small light reel should be placed, five feet long, on a stand four feet high, resting on a large slatted platform, called a scrave. This is intended to wind the cloth from off the furnace reel to the outside of the dye-house, when it is taken out to be aired. An opening, six feet long and nine inches high, is made in the partition of the dye-house, when of frame work, or in the wall, when of brick or stone; a little below the top of the furnace winch, and above the winch placed on the outside of the dye-house, on a line that shall be an inclined plane between the two. In this opening a small and smooth wooden roller is placed, for the cloth to pass over from the one winch to the other.

In colouring of black, the cloth has to be taken out of the furnace, two, three, and on some occasions four times, to air and cool, or, more properly speaking, by exposing it to the air, to give the iron an opportunity of becoming oxydized to its maximum. This was performed, until a few years since, by winding the cloth out of the hot liquor, upon the winch placed over the furnace, throwing it off from thence on to the floor, with a stick, and then cooling it by throwing the cloth backwards and forwards over a pole. It is now done by winding the cloth out of the furnace, by means of the apparatus just described, and when out, one of the men trundles it over the winch, on the platform outside of the dye-house, while another throws it out with a broading stick, to cool on the platform, on which the winch stands. The platform should be about sixteen or eighteen feet long and six wide.

When cloth was wound on the winch, it was ever liable to become heat-wrinkled, which always injured the sale of the goods, and the plan of winding out on a second winch was adopted, to prevent the possibility of such injury. As I am writing for the purpose of giving information to those who are not supposed to be acquainted with these casualties, it may be useful to explain more particularly what heat-wrinkles are, and how they are made. When cloths that are dyed black, and some other dark colours are wound up from the liquor on a winch, if it lies but a short time thereon, the nap will become matted together in narrow wales in all directions on the face of the cloth, and whatever pains may be taken with them afterwards, they never can be removed. The wool is apparently felted together, the points standing upright, and are so compactly united as to be inseparable by mechanical means. The finer the cloth, the more liable it is to become heat-wrinkled, and very coarse cloth is seldom or ever damaged in that way, nor are the finer qualities when the temperature of the liquor is below 150 degrees, Fh. The liability to wrinkle, is also as the quantity of copperas employed to produce the colour. The effect, therefore, is as the heat of the liquor and the quantity of copperas used in it.

ON THE SETTING OF DYE FURNACES.

IN all furnace dying, it is an object of importance so to set the furnaces that the liquor shall boil quick and with the least possible quantity of fuel. To effect this, will be the object of the following directions. I shall first describe the old mode of setting furnaces, and then the new, accompanying it with such remarks as will be necessary to elucidate the advantages of the latter.

In setting of large furnaces, the mouth of the fire-place should ever be situated on the outside of the dye-house immediately under the chimney. Several circumstances render this necessary. First, that the fire may not be communicated to any of the combusti-

bles inside, such as floors, &c. nor make the dye-house smoky to the great annoyance of the workmen—secondly, as it is occupying room that may be better employed, and leaving loop holes where workmen by falling in, may as I have sometimes known, be seriously injured. Thirdly, the mouth of the furnace being inside, the flues cannot well be set without having them to wind twice round the furnace, by which their capacity for heating, is very much lessened.

The old mode of setting large dying furnaces, was by having a fire made on narrow grating and carrying the brick work out to the shape of the bottom, so that only the edge of the furnace rested on the brick work sufficient to support it, and no more. At the other end, opposite the mouth, the heat passed through an oblong opening of fourteen by six into a flue that was open all round the furnace to the height necessary to close. The flue was ten inches wide at the bottom, and gradually lessened till it closed where it was only three inches. The heat from the fire passed through the oblong opening, and separated to the right and left, meeting again at another vent that is equi-distant from each edge of the former, through which it passed off into the chimney.

The modern mode of setting furnaces, by which much fuel is saved, is as follows: the grating is made, as before described, but the whole space round the furnace is left open, excepting four pillars for the furnace to rest on, and a small flue round the top, with eight or more apertures leading into it according to the size of the vessel, for the purpose of dividing the flame and heat, so as to make the draft perpendicular, or in other words, to cause the heat to strike the furnace in straight lines.

The last mode of setting furnaces, was patented in England about thirty years ago, by a person of the name of Lewis. At that time, Count Rumford's improvement made a great noise, and I had just then had a large furnace set upon his plan, having employed a workman from London who was at work under the direc-

tion of the Count's agent. I was induced to go to that expense, being fearful that country workmen would not do it correctly. The Count's mode was very complicated, and the setting very expensive; the flue was small, and ran spirally round the furnace, a damper was placed in the throat of the chimney, a closer at the ash pit, and a small draft door, on hinges, at the centre of the bottom of the furnace door. The alteration cost me more than thirty pounds, stirling, (nearly one hundred and fifty dollars,) and when done, would never boil the liquor when the cloth was working in it, so that it had all to be taken down again and the furnace re-set.

It is very certain, notwithstanding the Count's superior talent and splendid theory, that he had altogether mistaken the matter of heat on furnaces. In setting them, his object appeared to be to confine the heat, expecting by that means to drive it through the metal into the liquor inside of the furnace, than which nothing can be more erroneous. It is now well known, that the heating power of caloric is, as its angle of incidence, every thing else the same; hence the reason why the sun has so much more power within the tropics where it is vertical, than in milder latitudes, where its incidental angle is more enlarged. Just so does heat operate under furnaces. When it is brought up against the bottom at right angles, its impinging power is so much increased, as to heat the liquor inside in much less time, and with a smaller quantity of fuel than would be credited by those who have never experienced the difference. Keeping this principle in view, we can easily perceive why in Mr. Lewis's mode, the water in any given sized furnace, can be made to boil in one half the time, and with three-eighths less of fuel, than upon either the old plan, or upon Count Rumford's.

In every mode of setting furnaces prior to Lewis's improvement, the draught underneath was from the mouth to the back, parallel with the bottom; but as the air which supplied the fuel with oxygen, was admitted from below, through the bars of the grate, the position of the draught was thereby partially altered when the door was closed: supposing the incidental angle to be a medium

between the two operative draughts, it would impinge against the metal at an angle of forty-five, when the door was shut and at an angle much more extended when it was open. Hence the reason why a liquor boiling vehemently with the door closed, would cease either partially or altogether, almost at the instant of opening it. In Mr. Lewis's improvement, the fire operates against the bottom at right angles, impinging against it in the best possible direction, with all the power that is capable of being given to it, thereby bringing it into action in the best possible mode, and rendering all future attempts at improvement unnecessary, unless by an increase of the velocity of the draught.

One other particular must be attended to in setting furnaces for dying, that the flue round the furnace be closed so low that the fire may not reach above the liquor when it boils down during the operation. Should this ever occur, the cloth will be burnt in patches, and the inexperienced dyer will be unable to account for it.

ON BLACK DYING.

IN colouring of black, the liquor has, in all cases, to be boiled hard two hours previous to the goods being entered, and cooled down pretty low with cold water, before they are put in. As the receipts for piece dying will be given for one end, or for a given number of ends, it will be understood, that an end of broad cloth measures twenty yards, which when cut to furnace, usually weighs about twenty-seven or twenty-eight pounds. Sixty yards of single cassimere is equal to twenty of broad felt, as is forty-four of half milled, and thirty-six of double milled.

There are four different and distinct colours in black, the blue, the red, the yellow and the jet black. It will be necessary to keep this distinction in view in reading what follows, as well as in the

practice of the dyer; for as it includes all the primary variations that can take place in the colour, it will have a tendency to lead the mind to the cause of the difference, and thereby remove that confusion which too many artists in this line are labouring under. The terms I have used to distinguish the different colours, require no explanation, the blue, red, and yellow being the dyer's primary colours; every one must know, that when either of these predominate, the colour assumes that name. A jet black is that happy mixture of the three, in which neither of them is in excess so as to be visible.

TO DYE EIGHT ENDS OF CLOTH WEIGHING 220 POUNDS, A BLUE BLACK.

For boiling use.

80 pounds of chipped logwood (not more.)
12 do. of sumac (not more than sixteen.)
2 do. of pearl-ash (not more.)

Let the contents of the liquor be well stirred with a rake after the dye wares have boiled two hours. Cool down the liquor to one hundred and eighty degrees or thereabouts—then enter the cloth rapidly, and give it a few turns over the reel as quick as possible, having it kept open all the time by the broads-man. The fire is then to be made up as strong as possible, and no time lost in bringing the liquor to boil. After it boils out fairly, the time must be taken, and the boiling kept up for two hours, the broads man keeping the cloth open all the time. When it has boiled two hours, the furnace must be filled up with cold water, the door thrown open, and the cloth taken out and cooled as before directed. While this is doing, the fire is made up, the door closed, and the liquor brought to boil. The materials to be added this time, are

20 pounds of copperas.
4 do of blue vitriol (not more than six.)

After the liquor, with these ingredients, have boiled five or six minutes, the door is to be opened, the liquor cooled down with water as before, and the goods after well stirring, are to be rapidly entered. When eight ends are done at once, the reel must move with considerable rapidity for the first fifteen minutes, one person being employed to push the cloth under the liquor on one side, and another on the other side to keep it open; the reel being kept turning, and the cloth kept open during the whole operation. In order to avoid repetition, I must once for all, inform the dyer that in all piece dying, the goods are to be kept well opened by the broads-man, and the reel briskly turned from the time the cloth is entered, till it is taken out; for if this be neglected, the colour will be ever liable to be uneven. Immediately after the cloth is entered, the fire is to be made up, the furnace door shut, and the liquor made to boil as soon as possible. This is understood to be the first saddening, and the boiling must not be so strong as in the first process. When the cloth has been in two hours, and have boiled gently, at least one hour out of the two, take it out, having previously cooled it down with water, air the cloth as before, till nearly cold, and bring the furnace to boil, as directed, for the last saddening. The material to be added this time is only

8 pounds of copperas,

which has to be proceeded with as before, with this difference, that, when the saddening has been continued one hour, a pattern is taken off the lacing and scoured when the colour is matched with a good black pattern. If the colour is not full enough, or is deficient in body, the saddening must be continued longer. If the colour is wanted of a greener hue, add one or one and a half pounds of verdigris in the last saddening. If the body of the colour is too strong, lessen the quantity of copperas, and if too weak after going its full time of two hours, add more. In matching of colours, it must be understood, that both patterns must be either dry or wet; for, if one be dry, and the other wet, there will be many shades of difference in the colour, though they may match when both are in one state.

This receipt would produce a bluer black by not boiling between the first and second and the second and third process; but if verdigris is added in the saddenings, the liquor will have to boil before having in the cloth. When verdigris is intended to be used, it should be weighed off and put in soak in boiling water a day or two before it is wanted.

Many dyers who come from England and other countries, who understand but little of black dying, will prescribe a much greater portion of ingredients to produce the colour on the same quantity of goods; but this must be the result of ignorance, it having been proven, that too great a body of colouring matter injures a black, by making the shade brown, russetty and too heavy. To produce a perfect colour, the copperas and colouring matter require to be used in certain proportions, when less colouring matter is used, a larger portion of copperas is necessary, and when more is used, the quantity of copperas must be diminished.

The workmanship which I have prescribed for blacking with this receipt, must be observed for all others.

When a blacking is finished, the cloth should be about half cooled, then divided into ends, and each one folded up and placed across a wooden horse, where it should lie till the following morning to drain, cool, and give time for the iron to oxydize to its maximum, before it be washed; for if cleaned immediately after it comes from the dye, the colour will not be so good as when it has laid twelve or sixteen hours. The sun must not be permitted to shine on the cloth for any length of time between the dying and washing. If there be no shade to put it under, it should be covered with sheets.

I have divided this colour into blue, yellow, red and jet blacks, and there are innumerable shades of each. To produce these at the will of the workman, can only be acquired by long practice. I shall give receipts for each of these, and the dyer who has a knowledge of the business, can vary the body and hue at his pleasure.

Another blue black for twenty-eight pounds of cloth.

10 pounds of logwood.
2½ do. of sumac.
1 do. of fustic.
¼ do. of pearl-ash.

The wares to boil two hours, run up, stir well, heave in the cloth, and boil it three hours. Let the furnace be now run up, the cloth had out and cooled, then add the following ingredients to the liquor, only previously dissolving them in a bucket without boiling.

5 pounds of copperas.
¼ do. of blue vitriol.

When the cloth has been cooled, stir the liquor well, heave in the cloth, and boil gently for four hours, then run up, have it out, throw it, till half cold, and proceed as directed for the last blacking when finished.

Another receipt for a blue black, in which the colouring matter is lessened, and the copperas increased. For boiling six ends of broad cloth weighing about one hundred and sixty pounds, use

30 pounds of logwood.
15 do. of sumac.
3 do of pearl-ash.

Let the wares boil two hours, heave in the cloth, and boil two hours and a half; then proceed as for the first blacking. For the first saddening, use

16 pounds of copperas.
12 do. of ground logwood.
6 do. of blue vitriol.

Boil two hours, and proceed as for the first blacking.
For the second saddening, add

12 pounds of copperas.
4 do. of fustic.

Boil one hour, and try a pattern, if not black enough, continue boiling another hour.

The liquor must be boiled with the ingredients in both of these saddenings, for twenty minutes before the cloth is put into the furnace. It is necessary in all cases where dye wares are added to the liquor in the saddenings, that they should be boiled from twenty to thirty minutes before the cloth is entered, or the colour will be uneven.

TO DYE EIGHT ENDS, OR 220 POUNDS OF CLOTH OF A YELLOW BLACK APPROACHING TOWARDS A JET.

For the boiling use.

60 pounds of logwood.
16 do. of sumac.
12 do. of fustic.
1 do. of pearl-ash.

The wares must boil two hours, the cloth two and a half, cool down, heave out and cool the cloth.

For the first saddening use.

20 pounds of copperas.
4 do. of blue vitriol.

The ingredients to be dissolved and added without boiling the liquor, and the cloth to boil two hours, then heave out, &c. as before.

For the second saddening put in

25 pounds of copperas.
4 do. of fustic.

The ingredients are to be boiled twenty minutes, then heave in the cloth and boil one hour and a half, heave out, cool, &c.

Add for the third and last saddening.

5 pounds of copperas.

10 pounds fustic.

The wares to be boiled twenty minutes, and the cloth to go one hour and a half, with boiling gently for half an hour.

TO DYE EIGHT ENDS, OR 220 POUNDS OF CLOTH OF A RICH REDDISH BROWN BLACK.

For the boiling use.

80 pounds of logwood.
18 do. of sumac.
12 do. of fustic.
4 do. of argol.
6 do. of madder.
2½ do. of verdigris.

Let ingredients boil two hours and the cloth run two hours, proceed as usual.

For first saddening use.

22 pounds of copperas.
2 do. of sumac.
2 do. of fustic.

Boil the wares twenty minutes, heave in the cloth and boil two hours.

For the second and last saddening use.

20 pounds of copperas.
2½ do. of blue vitriol.
2 do. of sumac.
6 do. of madder.

Boil the wares twenty minutes, heave in the cloth and boil it gently till the colour is rich enough.

I have before remarked, that when dying wares or verdigris are added in any of the saddenings, the liquor must always boil twenty or thirty minutes before the cloth is entered; but when

only copperas and blue vitriol are added, it may boil or not, at the option of the dyer. When put in without boiling them, they must be previously dissolved in a bucket, particularly the blue vitriol which is very difficult of solution. Let me here remark, that in all cases before the cloth is entered into the furnace, the liquor must be well stirred with a dye-house rake.

TO DYE TWENTY-EIGHT POUNDS OF CLOTH A JET BLACK.

For the boiling use.

10 pounds of logwood.
2½ do. of sumac.
2½ do. of fustic.

The wares ought to boil two hours, and the cloth three, heave out and cool as before.

5 pounds of copperas.
¼ do. of blue vitriol.

The ingredients to be dissolved in a bucket, and added to the liquor without boiling; the cloth to be boiled four hours, run up, heave out, and proceed as directed for the first blacking.

The following receipt for a jet black, answers better than any other I have ever tried. The body is strong, the colour is of a superior hue, and is so permanent, that it will wear without changing as long as the stoutest cloth will last. I once sold the receipt in England, for this process, for three hundred pounds sterling.

For one end of felt, weighing twenty-eight pounds:—
1 pound of argol, (crude tartar.) Cream of Tartar will answer as well.
½ do. verdigris; not more than ten ounces.
Dissolve the verdigris, by putting it in a bucket of boiling water

the day before using it. Bring the furnace to boil, and boil the materials one hour. Heave in the cloth, and boil it two hours, then heave it out, fold it up, and let it lay twelve hours or more, not exceeding two days. It is then to be washed in a poacher, and a fresh-liquor made for colouring it.

To colour to advantage with this receipt, there should be two furnaces employed, one for the above preparation liquor, and a second for finishing; for after one lot has been boiled, if others follow it in the same liquor, one-sixth of the above proportion of ingredients may be saved, and the liquor will not be injured by being kept for months, provided it does not lay more than a week at one time in a cold state.

When the cloth has been prepared, as above stated, it has to be finished in a new liquor, as follows:—

10 pounds of logwood.
4 do. of sumac.
½ do. of fustic.
12 do. of white oak saw dust.

Let the wares be boiled two hours, the cloth heaved in, and boiled three hours. For the first saddening, use

3 pounds of copperas.

Dissolve and put in the copperas, heave in the cloth and boil two hours. For the second saddening, use

2 pounds of copperas.

Dissolve the copperas; heave in the cloth, and boil one hour and a half. Should any of the colours be too strong in body, use a smaller quantity of logwood, or the same quantity, and less copperas.

For dying a rich red black, take any of the receipts, excepting those for blue blacks, leave out the fustic, and add in place of it, two pounds of ground barwood, and one of alder bark, for every twenty-six pounds of cloth, dividing these between the saddenings, where there are two, and add it at once, where there is only one.

After blacking, and the cloth has lain across a wooden horse for twelve or fourteen hours, let it be streamed and scoured, according to the directions given under the head scouring of cloth.

To prevent the colour from being cloudy and uneven, the liquor must, in all cases, be lowered down before the cloth is heaved into the furnace, and it should be rattled over the reel as fast as the broads-man can keep it open for the first quarter of an hour, and the cloth should be kept under the liquor, on the opposite side, the same space of time. It is also essential, as I have before stated, that the cloth should be kept moving moderately, and opened during the whole time it is in the furnace. It may not be amiss to repeat the precautionary measure of never crowding the cloth too much in the furnace; the quantity of water for one end should never be less than one hundred and twenty gallons, and one hundred and forty is still better.

After blacks are scoured, should any of them be too brown, or have a russet hue, they may easily be remedied as follows: bring on a furnace of clear water to a blood heat, and add to it as much oil of vitriol as will give to the water a pleasant sour taste, then run such colours in it, until they become of the hue wanted, without raising the temperature of the liquor. By this simple process, all brown blacks may be made jet, and the cloth will handle the softer for it.

Although the receipts I have given for black are the best that England afford, yet I would not recommend the American dyers to follow them implicitly, for there are many articles in this country, that might be employed to much advantage. Oak barks, however, ought never to be employed in black dying, for though a good colour may be made from many of them, yet they always wear brown, and will turn of a russet hue in a very short time, particularly in the summer season. Let them employ the swamp maple bark in place of sumac, and the alder in lieu of fustic. When swamp maple bark is used, the quantity of logwood should be dimi-

nished, in as much as this bark produces a strong purple body similar to nut-galls, for which logwood is a substitute.

As a guide to those who are but little acquainted with colouring, I will add a receipt for this kind of black which I apprehend should make a good colour.

For one end of felt, weighing twenty-eight pounds, for a jet black. Use for the boiling

7 pounds of logwood.
6 do. of swamp maple bark.
2 do. of alder bark.
½ do. of verdigris.

Boil the materials two hours; heave in the cloth and boil it two hours and a half; take out and cool as before directed. For the first saddening, use

3 pounds of copperas.

Heave in the cloth and boil gently two hours; then heave out and cool. For the last saddening, use

2 pounds of copperas.

Heave in and keep at a spring heat for two hours. By a spring heat, the dyer means a gentle bubbling boil, without proceeding to a strong ebullition. Take a pattern off, after the cloth has gone one hour; scour and match it, should it then be a good black, heave it out, but if the body be not strong enough, continue the saddening another hour. Should not the colour, after having, gone its full time, have sufficient body, use more logwood, or more copperas, and less of these, should the body be too strong.

When an English dyer is desirous of having a black unusually rich and full bodied, he prepares the material at the season when walnuts are ripe. He purchases the green hulls from those who grow the nut, and puts them into large hogsheads, filling them with

water so as to cover the hulls. It must be understood, that these hulls, if left in a heap only for a few days after they are taken from the nut, will be spoiled for this purpose, and that when in the casks, they must always be kept covered with water, for if any are permitted to lie on the top uncovered, they will soon be injured. A dyer uses them after a black has been coloured, when it has been washed clean in the stocks, but before scouring with earth. For enriching eight ends, or two hundred and twenty pounds of black cloth, put into a furnace of clean water from eight to sixteen gallons of the hulls, with the proper portion of their liquor, add to these four pounds of alder bark, boil the ingredients two hours, cool down with water, and rake the hulls and bark out of the liquor.—When this has been done, enter the cloth, and run it without any additional heat till they are of the desired colour. This will add very much to the body and permanency of the black, and will make the goods handle soft. It is a fact not generally known, that any colouring matter put on in this way, after a black has been dyed, will increase the body of the colour much more than when the same material has been added in the first process, and in almost every instance it will appear the blacker.

I apprehend that the hull of the butter-nut, or white walnut of this country, would answer very well for this purpose, as it affords a rich brown, very similar to the colour given by the hulls of the English walnut, and is, as I understand, highly permanent. It should be collected when the nut is ripe, and proceeded with as directed for the other.

Having given all the information that is necessary for dying of black in the cloth, we will now proceed to dying it in the wool

TO DYE BLACK WOOL.

THE furnaces for colouring of wool are constructed and put up in a very different manner from those which are used for cloth dying. They are made after the same manner as a soap-boiler's furnace, with a small metallic bottom, either of iron or copper, and a large wooden head. It is of much greater diameter across the top than where secured to the metal. In England, these furnaces are usually large enough to colour from three to six hundred pounds of wool at one operation; but as the principal part of them is wood work, a small quantity may be done when necessary. It is always better, however, to dye large quantities at a time, as three hundred or more can be done at the same expense, for wages and fuel, as forty or fifty, and those items always constitute, in cheap colours, full one half of the expense attending the dying. It is by doing large quantities that the English dyers and manufacturers have very much the advantage over those of this country; for independent of the saving in fuel and labour, the larger the quantity done at one time, the less will be the proportion of dying wares used, in producing any given colour. The wood work of wool furnaces is bound with stout iron hoops, three inches wide, after the same manner as described for the woad vat. The wooden staves must be as stout as those for the vat, and one of the iron hoops driven close to the top, and well rivetted on, as there will be a great strain on that part during the working.

The tools used to work wool are a rake and a stang. The rake has a wooden handle, long enough for the workman to stand on one side of the furnace, and to throw it to the side opposite to him, without stooping over the furnace liquor—the handle is made somewhat stouter than those used by hay-makers; for the purpose of raking, iron prongs are placed in it at one end, dropping down from the end of the handle about nine inches and spreading at the points to six inches. An iron ring is put on the handle, where the shaft of the prong enters, to prevent the wood from spitting. A stang

is a round and smooth wooden lever, about three inches diameter, when intended for a large furnace, and long enough to reach to the bottom of the furnace, and to extend above the top about four or five feet.

The following receipt is for a black, where the wool was previously dyed a middling blue in the woad vat, and is for forty-one pounds of scoured wool. When black wool is dyed in this way, the colour never changes by wearing, but will look bright, full bodied, and of a fine jet black, until the garment is worn out.

Woad the wool to the blue wanted, and wash it well, then boil the dye wares in the furnace in bags. The bags used for this purpose are very open in the texture, and coarse, but strong, and they should be made to hold double the quantity of dye wares intended for an operation; for when a bag is crowded, the liquor cannot penetrate so as to extract all the colouring matter of the woods contained in them. When the furnaces are large, and great quantities are intended to be coloured at each operation, at least four such bags should be provided for each furnace.

Receipt for forty-one pounds of black wool.

25 pounds of logwood.
7 do. of maple bark.
6 do. of fustic.

Boil these in bags for four hours, take out the bags, run up the furnace with cold water, and heave in the wool, handle it well for half an hour, and boil it three hours. It will be necessary to explain what is meant by handling of wool in the furnace. I have before described the rake and stang, the tools with which this is performed. The wool must in all cases be completely scoured, and well washed, before it is coloured, and it is essential to have it in a moist state when entered in the furnace. Before the wool is put in, the liquor must be cooled down with cold water to about 170° Fahrenheit, then stir it well with a dye-house rake, and throw in the wool. While one person is throwing in, another is employed

to push it under the liquor with a stick; when the whole is in and under the liquor, take the rake and draw all the wool from that side of the furnace opposite to the workman, to that where he stands, then thrust the long lever or stang down to the bottom of the furnace, on the same side, forcing the wool down with it, when the stang approaches the bottom, thrust it towards the opposite side, along the bottom, and bring up all the wool to the surface, let the stang be now drawn towards the workman, one or two feet, according to the size of the furnace, which acts as a fulcrum to the lever, and with the weight of the body suspended on the end, lift up the wool above the liquor, and by a jerk and a twist of the stang shake the wool abroad on the surface of the liquor. Let it be now raked over again and proceed as before. These directions must be kept in view, and the operations pursued in every instance where wool is to be dyed in the furnace, for, if neglected, the colour will be uneven.

It will be seen that half an hour is prescribed for working the the wool after it has been heaved into the liquor—by the time this has been performed, the liquor will begin to boil, and must be kept boiling slowly all the time prescribed without any other handling. The same process will have to be pursued for all wool colours that are dyed in the furnace, therefore, I need not repeat these directions for any receipt that may hereafter be given, only mentioning the time of boiling, handling, &c.

When the wool has gone the time prescribed, it has to be saddened with the following materials:

2½ pounds of copperas,
1½ do. of alum.

Handle well for half an hour, then boil one hour, and let lie all night. The ingredients used in the saddening must be dissolved in a bucket of the liquor before the time of using them, and the liquor in the furnace cooled down with water as low as convenient, before any of the saddening compound is added. When this has been done, one person should be actively employed handling the wool,

while another strews the saddening liquor over the surface of the furnace, in small quantities at a time, permitting one quantity to be mixed thoroughly with the wool before another is added, administering it at regular progressive periods, till the whole of the saddening solution has been added, then continue to handle afterwards for the space of ten or fifteen minutes.

Receipt for colouring seventy-five pounds of wool for a black mixture.

This proved a very good colour, and was permanent. It must be understood that the quantity of dye wares prescribed are always for clean wool, as an English dyer never attempts to colour it in any other state.

23 pounds of logwood.
2 do. of blue vitriol, or 1½ of verdigris.

Proceed as directed for the first receipt in the boiling of wares and wool, boil the wool three hours and let lie all night.

Receipt for eighty pounds of wool for a black mixture.

28 pounds of logwood.
4 do. of alder bark.
2 do. of fustic.
½ do. of potash.

Boil the wares in bags four hours, take the bags out, run up the liquor, heave in the wool, handle forty minutes, and boil three hours —then strew over

6 pounds of copperas.
2 do. of blue vitriol.

Handle till colour is even, boil one hour, and let it lay all night.

Receipt for colouring a raven black for a mixture or for a wool colour.

First woad two hundred pounds of wool of a light blue, then boil in bags thirty pounds of logwood for four hours, heave in the wool as before, and handle one hour, as it must be that time before the liquor comes to boil—then strew thirty pounds alum over it, han-

dle and boil two hours, and let it lie all night. Wash the wool on the following morning, and bring on a fresh liquor, in which boil fifty pounds of logwood for three hours, and let it lie all night. Wash the wool on the following morning, and bring on a fresh liquor, in which boil fifty pounds of logwood for three hours, heave in the wool, and let it be four hours coming up to a boil, then boil a quarter of an hour, cool down and let lie all night. It should be handled for the first two hours. This colour will be a rich blue black, or what is called a raven, being the hue of the wing of that bird.

TO DYE BLACK ON COTTON.

I SHALL proceed to give three Manchester receipts for dying of cotton on black. These receipts were obtained from that town a few years since, and I have received fifteen dollars for one of them, after permitting the person to try it before he paid the money. I have never tried any of them myself, but as they come from a first rate dyer, who freely offered them without fee or reward, I have full confidence of their being exactly such as were used by himself.

The cotton has first to be dried a light blue, in the usual cotton blue vat, and then washed. For each pound of cotton to be dyed, boil four ounces of sumac, and a double handful of logwood chips, which has been boiled before for other colours; when these are boiled, take the clear liquor and add to it half a pint of urine, turn in the cotton, handle well, and let it lie all night. Take it out in the morning, dissolve for each pound of cotton half an ounce of copperas, turn the cotton into this liquor, and work it well for ten minutes, repeating the same ten or twelve times, wring out and wash well—put another half pint of urine into the sumac and logwood liquor, turn the cotton again into this, for fifteen or twenty minutes, handling it now and then—dissolve another half ounce of

copperas, and add it to the former copperas liquor, turn in the cotton, and repeat as before, wring out and wash well. Boil for every pound of cotton, twelve ounces of logwood chips for half an hour, take off the clear liquor, and add half a pint of urine for each pound of logwood, turn in the cotton for half an hour at the usual heat, work it well, raise it out, and leave it to drain upon a pin—dissolve for each pound of cotton, twelve ounces of copperas, put it into the logwood liquor, stir well, and turn in the cotton for half an hour, work it well, wring out and well wash—boil the first sumac and logwood liquor again for half an hour, put in a handful of ground black oak bark for each pound of cotton, and turn it in at the usual heat—dissolve for each pound of cotton, two ounces of copperas, pour it into the last liquor, stir well and turn in the cotton for twenty minutes—wring out, wash, dry, and it is finished.

SECOND RECEIPT FOR DYING BLACK ON COTTON.

BEFORE giving this receipt, it will be necessary to give directions how to prepare the acetite of iron and the pyroligneate, to which I shall add the pyroligneate of copper, as each of these compounds will be prescribed in dying the different colours on cotton and silk.

To make the pyroligneate of iron, dissolve four pounds of copperas in twenty pounds, or as many pints of rain water, and filter it—then dissolve four pounds of pot-ash in twelve pounds of rain water, and filter this also on another filter, mix the two liquids together, expose the mixture to the air, and when by the exposure, it has attained a deep red colour, then pour the whole on a linen filter; when the water has passed through, there will remain on the filter a red oxyde of iron which must be washed with much water till it has no taste of salt—this washing is done on the filter, and when completed, place the red oxyde of iron on a clean board until it is dry, and has attained its maximum of oxydizement, then

place the oxyde and triturate, or rub it in a marble mortar, pour on it as much pyroligneous acid as will dissolve it, and filter again.

The pyroligneate of copper is made as follows: take one pound of blue vitriol, dissolve it in six pounds of rain water, then dissolve one pound of pearl-ash in three pounds of rain water, mix the two, put it on the filter, wash it, and dissolve in the pyroligneous acid, as directed, for the oxyde of iron. When the pyroligneate of iron and copper are wanted in combination, take three parts of the oxyde of iron as it remains on the filter, after it is dry, and of the oxyde of copper in the same state, triturate them in a marble mortar, pour on them as much pyrolignic acid as will dissolve them, and filter the whole. These mordants are much used, either separately or combined, for dying of silk and cotton.

The pyroligneous acid, as the term denotes, is an acid extracted from wood by distillation. The purest acid of this kind, is very expensive, there being much trouble and expense incurred in separating all the empyreumatic oil from it; but that which is commonly used for the purpose of dying, need not be very pure—all that is necessary is to have it so clean from the oil that none of it shall adhere to the goods.

Common pyroligneate of iron is made after a more direct manner than that which I have before described. The acid is put into a large iron-bound cask, to which is added old iron hoops, the dust which falls from the stones in grinding edge-tools, or fine turnings of iron; and the liquor is left to stand open a great length of time, the longer the better.

The pyroligneous acid, in its crude state, as it is collected from the still, will dissolve double the quantity of iron that will be taken into solution by the strongest vinegar. The most ready and direct way of making the solution is by boiling iron filings, turnings of iron, or old iron hoops, in this acid, in a cast iron furnace, for three or four hours. Some little of the acid will evaporate, but the

strength of the compound will be much increased. It must be remarked, that the iron should be free from oil, and as much rusted (oxydized) before it is put into the acid, as possible. One quart of this concentrated solution will produce effects nearly equal to four of the common acetite which I shall presently describe.

The pyroligneous acid is now made in this country by the white lead manufacturers, and is offered by the barrel at one shilling, New-York currency, per gallon, which is about the same price as cider vinegar.

Independent of the property which this acid possesses, of dissolving a much greater quantity of iron than strong vinegar, it has combined with it a considerable portion of the gallic acid, that cannot be discovered by neutralizing it with an alkali; but which greatly assists its colouring property by turning the red oxyd of iron to a dense black oxyd. This solution, in all colouring for a black dye, is far preferable to copperas, particularly when used on cotton, silk, or hair, and independent of its superiority as a dye, it leaves the goods in a much softer state than when copperas is used, and it also appears to impart a permanency which the other never gives.

The common acetite of iron is made by putting strong cider or wine vinegar into a vessel, and adding iron the same as before. In many dye-houses in Europe, they keep large vats, holding one or two thousand gallons each, in which they make this preparation, and some of them are not used out till they are more than one hundred years old, and the older they are, the more completely will the liquor produce the desired effect. For some particular purposes, they add alder bark, &c. to these liquors.

We will now proceed to the second receipt for dying of black on cotton.

Dip the cotton in four quarts of the common acetite of iron, or in two of the pyroligneate made by a cold solution to each pound of cotton, let it lie all night, in the morning wring it out and dry, and afterwards wash it well. Boil in a copper vessel four ounces of sumac, eight ounces of umbro madder, and two ounces of logwood for each pound of cotton—boil the sumac and logwood together for one hour, and empty the clear liquor into another furnace into this liquor, put the madder and drive on the fire till it just boils, then draw the fire, and when the liquor is milk warm, enter the cotton as in the blue vat, bring the liquor to a boiling heat in one hour and a half, but not to boil out, let it lie at that heat for fifteen minutes, then draw the fire, place the cotton hollow and straight, and let it lay so for one or two hours, then raise it out of the liquors and wring gently, shaking the madder well out of it—take it out one string at a time, wash clean from the madder, wring evenly and dry. In the summer, dry it under a shade, and in the winter in a stove.

The third and last receipt for cotton, is much cheaper, but not so permanent, nor does it make so fine a colour as the others.

Boil a sufficient quantity of sumac for half an hour, strain the liquor, into which enter the goods, and work well for half an hours wring out, dip it in water and urine, and then rinse it—dissolve copperas in water, into which enter the goods, and handle them rapidly for half an hour, then wring them out and enter them into pure lime water. Boil logwood in water for an hour, and strain it through a cloth, enter the goods in this and work till it be of the colour wanted. It must then be exposed to the air to dry. If dark enough, wash it, and re-dry it; if not dark enough, give it another dip through the same materials. Cotton, which will not take up more than a given quantity of colouring matter at one operation, will, after dying, take up a second portion; and whenever a strong rich colour is wanted on cotton, it is better to give it one portion, then to dry and wash, when it will take a second very

readily. By repeating the operations any body of colour may be obtained.

TO DYE BLACK ON SILK.

TAKE any quantity of vallineux, boil them in a copper, strain the liquor into a back of such a heat as will not interfere with the resin of the silk—put the silk into this liquor for three days, turning it once a day, wash out and stick up to drain. Bring on a kettle full of clean water to a boiling heat, put into it a great quantity of copperas, with a small portion of logwood and alder bark liquor, give the silk four wets in this liquor boiling hot, wring out over the kettle, hang up and dry in a stove. It may be scrooped with lime-juice; should it feel harsh, beat it well with fullers' earth on a smooth stone, then wash it clean, wring as dry as possible, and hang it in a stove to dry.

Vallineux is the cups and stalks on which the acorns grow of some peculiar oak; it is imported largely into England for the purpose of dying, and for tanning some kinds of leather. I once sold this receipt in Rhode Island, on condition of its producing a good colour, in which I substituted a strong decoction of sumac and swamp maple bark, in lieu of the vallineux, and the substitute answered so good a purpose, that the dyer called soon afterwards and paid the money, acknowledging that it made an excellent colour.

The silk died by this receipt, was the raw article in skeins, which always contain a considerable portion of natural resin that must not be disturbed by the heat of the liquor: hence the reason of the precaution used in the receipt. It will be understood, that when the gum is mentioned in any other receipt, it has reference to this explanation.

The alder bark liquor, mentioned in the receipt, is made as follows: take any quantity of pyroligneous acid, fill casks with it of one hundred gallons, each two-thirds full, into each of which, put two bushels of chipped alder bark, and a large quantity of old rusty iron hoops, turnings of iron, or of the dust of iron that falls off in grinding of edge tools; the latter is mixed with a part of the stone, which will by no means injure the compound. The older this preparation is, the more completely will it answer the purpose. For a large well established concern, it is usual to sink the casks in the ground on a bottom of well puddled clay, and claying them well up to the top; over each cask is placed a cover with holes bored through them. These are used to prevent accident, at the same time they give free access for the atmospheric air to operate on the liquor, this being essential to the proper oxydizement of the iron.

Many of the colours in silk dying, are scrooped with lime-juice, which is done after the colour has been dyed. To do this, some lime-juice is put into a tub of clean water, the coloured silk is immersed in it, and a few turns given, when it is wrung out and dried. This is done for the purpose of making the colours clear and bright, and in black for taking off any russet hue that may have been left by the colouring. This remark will be kept in view whenever scrooping is mentioned in other receipts.

TO DYE BLUE.

I SHALL begin with the woad vat. Let the reader refer to what has been said under the general head of dying, relative to setting of vats, and he will there see an account of the manner of erecting of the cold, the fire and the steam vats, also directions for manufacturing of woad.

It may be useful to the dyer to know how to measure the contents in gallons of a blue vat, or of any other conical or cylindri-

cal vessel; for it will be perceived, in the course of the following instructions, that the quantity of material must always be nearly in a given ratio to the contents of the vessel employed.

When a vat is cylindrical, that is, when the diameter of the length, from top to bottom. is the same, multiply the diameter in inches by itself, and cut off the right hand figure, and the remaining figures express the ale gallons in a yard length of that cylinder, near enough for every practical purpose, it giving only one gallon in three hundred and seventy-nine too little. When a conical vessel has to be measured, that is, a vessel that is larger at one end than the other, and regularly widening from the smallest end to the largest, take the mean diameter, reduce that to inches, and proceed, as described, for the cylindrical vessel.

As an example of this rule, we will reduce the English and French vats, before described, to their contents in ale gallons. An English woad vat is there stated to be seven feet six inches deep, the same in diameter across the bottom, and six feet on the top, the mean diameter will be six feet nine inches taken at the centre. This reduced according to the rule, will stand thus, 81+81=656,1, gives six hundred and fifty-six beer gallons in three feet of the vats depth—now the vat being seven feet six inches deep, or two yards and a half, we multiply 656+2½=1640 galons as the contents of the vat. The French vat is said by Mr. Cooper to be nine feet deep by five feet nine inches over 69+69=476,1+3=1428 gallons. Most practical dyers, without measuring, would consider the French vat as likely to hold more than the English, although its contents are one-eighth less. This proves, how necessary it is to ascertain the contents, before a vat is worked, for were the same materials to be used in both of these, one of them would be too strong, when the other would have only its proper quantity. It also shows, that it is necessary when receipts are given for woad dying, that the contents of the vessel should be given with it, otherwise an artist ignorant of the business, might fail for want of being put in possession of this very simple fact.

An English vat of the size described, is set with five times one hundred and twelve pounds of the best woad, five pounds of umbro madder, one peck of cornell and bran, half of each, the refuse of wheat, four pounds of copperas, and a quarter of a peck of dry slacked lime. Before we proceed, it will be necessary to give directions for preparing the lime, as the success of the dyer will very much depend on having this article properly prepared.

For two English vats, it will be necessary to prepare half a barrel at one time. The lime must be such as has been lately taken from the kiln, for no part of it should be air slacked, as that which has fallen by absorbing moisture from the atmosphere, will be recarbonated, and produce no effect upon the vat liquor. Take the new lime, put it on a clean stone floor, and pour sufficient water over it from a watering-pot, to make it fall into a fine dry powder, but not enough to make the mass wet when fallen. When enough watered, put it up into a close heap; throw a wool bag over it, and leave it till the following morning. The heap has then to be opened, and the stones, if any there, are taken out of it. It must now be put into a box having a close lid and left for use. Care must be taken to have the box, in which the lime is placed, as air tight as possible. I have directed the lime to be slacked on a stone floor to prevent accidents by fire, for when lime is slacked on wood floors, it will sometimes set them on fire, as I once experienced.

The woad will have to be chopped into small lumps with a spade, and thrown into the vat before the liquor is put in; let the madder be broken into small pieces, and the bran or lime thrown upon upon them. When the materials are in, it should be filled up with water that has boiled and cooled down to about 195° Fhn. from a furnace, and the contents kept stirred all the time it is being filled. When the vat is full to within four or five inches of the top, give it a good stirring for half an hour, and then cover down close. A dye-house bucket should hold four gallons, and while the vat is stirring after it has been filled, put in one bucket of well ground

indigo, containing fifteen pounds of that article. The vat should be set about four or five o'clock in the afternoon, and be attended and stirred again at nine o'clock the same evening, by this time, if every thing goes on regular, the fermentation will so far have progressed, that, when a small portion of the liquor is let run from either, a scoop or any tin vessel between the person viewing it and the light, it will appear of a dark bottle green. When well stirred, let it be covered down, and if the weather should be cold, throw some mats or wool bags over the covers to keep in the heat, to prevent its cooling too low before the liquor comes properly to work. The person who manages the vat, must attend at five o'clock the following morning, let them take off both covers and plunge the rake into the vat, so as to bring some of the air that is carried down by it to the surface, when a part of the sediment of the vat will rise with the bubbles. If the fermentation has progressed, as it usually does, the air bubbles will appear of a fine blue, and a number of copper scales will float on the surface of the liquor. Should these appearances take place, and the liquor, when viewed by transmitted light, be of a dark olive green, put into it another bucket of ground indigo and a quarter of a peck of the slacked lime, stir the liquor for twenty minutes, and cover down close. The heat of the vat should now be at about 140° Fh. and if it has lowered down below 135°. and it be a fire vat, a fire must be applied to raise and keep it at the latter heat. Two hours after this stirring, it must be stirred again, when, if the fermentation is found to have gone on in regular progression, the liquor will be of a brighter olive than in the morning, the bubbles will be of a richer purple, and the surface more generally covered with copper coloured scales; should these symptoms make their appearance, add another quarter peck of lime, stir for ten minutes, and cover down close as before. The liquor must now be stirred every two hours, and if the appearances continue to improve, a quarter of a peck of lime will have to be added at each stirring, until there have been given from eight to ten quarterns including the one that was put in when the vat was first set. By the time eight has been added, the liquor will look very rich in the bead,

the bubbles will rise of all sizes, from the bulk of an egg to that of a small hazle-nut, and none of them will break so as to disappear; but many of them will collapse, and as they fall together, will appear of a rich smalt colour, coated with a fat looking skin. A large quantity of bubbles will have risen by this time, which laying on the surface in a compact mass will look rich, and the greater part will have passed from a blue to a copper colour. The indigo now when raked up, will show in the liquor in clouds, its appearance will be a rich yellow olive clouded with indigo. When the vat assumes all these appearances, it is said to be in fine condition, and every thing will have gone on in regular order; but as it often happens, that a vat does not come on in a regular way, the vat-man must be attentive to appearances, when he stirs the first in morning after setting. If the bubbles and head is at that time weak and watery, and the last that rise should not show any appearance of blue, and the liquor shows no copper scales on the surface, and appears of the same colour as when stirred the evening before, something must be added to force the fermentation, and nothing will answer the purpose better than a liquor made from boiling together bran, malt, hops, and madder. This liquor, which is called swill, should be prepared the same day the vat is set, by putting into a copper furnace of one hundred and fifty gallons, two pecks of bran, one peck of ground malt, four pounds of madder, and one pound of hops. The furnace having been previously two-thirds filled with water, bring it to a boil, and, when near boiling, break and rake it in; a bucket or two of cold water should be kept near the furnace to throw in when necessary, to prevent the liquor from overflowing, which it is very apt to do when it begins to boil. When the liquor has boiled from thirty to forty minutes, draw the fire and run the furnace up with cold water, the sediment will soon settle and leave the liquor clear on the top. Should not the fermentation have come on strong enough when the vat is stirred in the morning, add one bucket of swill without giving it any lime, and cover it down close; in two hours afterwards stir again, and, if the appearances warrant it, proceed as first directed; but should these be still unfavourable, add two buckets of swill

at the second stirring, cover down and repeat until the appearances become favourable so as to proceed with the liming. It will seldom happen that a vat is delayed in coming to work unless the fermentative quality of the woad has been injured in making.

I have directed that from eight to ten quarter pecks of dry slacked lime be used when a vat is set with five hundred weight of woad; but as the quantity required, will altogether depend on the strength of the woad, as well as on that of the lime, there can be no absolute rule given. I have found, however, that the Rhode Island lime is nearly of equal strength with the English Cromwell, being that which is used for this purpose in the west of England, and I would recommend those who attempt the woad vat to use that lime, provided they should follow these directions.

There is probably no article more uncertain in its strength and quality, than woad. The principal object to be attended to in the purchase of woad, is to procure it of the strongest kind, and to take care that the supply be uniformly of the same strength; for any considerable variation in this particular, will prove very disastrous to the operator, however skilful he may be in his profession, and will be altogether ruinous to a young beginner. It is very rare to see even a fair sample of woad in this market; for that which have been imported, have generally been such as was not saleable in England. I lately imported some of the best kind, such as I formerly used there, and such as my brothers now use, from whom I obtained it. To encourage the consumption, I was induced to offer it at fourteen cents per pound, being six cents lower than it was ever before sold in this country. As soon as an opportunity offers, I shall induce some agriculturist to undertake its manufacture.

I must request those who are interested in the consumption of woad, to look back, and read attentively the letter of Mr. Parish's, on the raising and manufacturing of woad, they will there see that its relative value depends altogether on the strength of the land

on which it has been raised—that when raised on poor land, it is of little value; but that when raised on strong land, in a favourable season, it is highly valuable, and that the strongest land will not bear more than two crops in succession.

A dyer at all conversant with the woad vat, may, by taking prime woad and following my instructions, bring it into good work and produce colours equal to the English; but should they take woad at hazard, no certain rule can be given. I have seen at one dye-house in the state of Massachusetts, four kinds of woad in different states of preparation, the workman was an European and appeared very skilful in his profession; but he complained very justly, that he could not work his vats regularly, owing to the great difference in the quality of the woad. The owners of factories may rest assured, that their woad dying will never equal the English until they procure woad that shall be nearly uniform in strength and condition.

When the vat has been brought to work, as before directed, a cross is suspended in it, on which the net will have to rest—about forty pounds of wool is wet in at once. The wool must be thoroughly cleansed from the grease and yolk, and well shook on the floor close to the vat before it is entered. One man should strew it over the top of the liquor, and another put it under with a vat stick; when it is all in, it must be handled very briskly the whole time when the vat is new and strong of indigo, or the colour will be uneven; when a liquor has been worked some time, and the strength of the vat lowered, the wool need not be handled more than one-third of the time. In a new strong liquor, such as I have given directions for setting, the wool should not be permitted to remain in it more than half an hour, when it will have to be wrung out at three wringings, which should be performed as quick as possible, and wrung very dry. As soon as the workmen throws one lot out of the wringing cloth, another person should immediately shake it up, so that the air may have access to all parts of the wool, and then reshake it into a heap—soon as the whole is out of the vat,

et the heap be again shaken until the wool is nearly cold. It must be noticed that a woad vat should never be worked at more than 125°, and when new, at no more than 115° Fh.

In dying with woad, there should always be two vats in operation at the same time, one that has been worked for one or two months, and a new vat. The wool to be coloured, should be primed in the new vat, and finished in the older one.

A vat that is set with five hundred of strong woad, will require five hundred more during the working, and this, in all regular dying establishments where constant work is required, will colour for six months; in that time it will take nearly five hundred pounds of indigo. The workmanship, after the first setting, to be managed as follows; dip two or three wets of forty pounds each into the vat after it has been brought to work at night after the last dip, stir well, and if the liquor is cooled below the proper standard, put the fire on and bring it up to 125°, not exceeding 130° Fh., stir again at nine in the evening, and put in two quarter pecks of lime. The day following, the same wets may be redipped, when they will be a pretty full colour, bring the heat up as the night before, after stirring, and when the vat is stirred at nine o'clock, give it one quarter peck of lime. The day following the vat must be renewed.—First bring the heat up to 155° or 165° Fh.; when brought to the requisite heat, put in half a hundred of woad, chopped fine as before, half a peck of bran, four pounds of madder, and twelve pounds of indigo well ground; stir well after these things are added, and again at nine in the evening. The next morning it should be yellow in the liquor, have a thick copper scum on the surface, the bede be of a fine purple and very rich. Stir again at five o'clock the following morning, which repeat at noon and in the evening, at the last stirring, add two quarter pecks of lime. It will now bear working and replenishing regularly. When constantly worked it will, so long as woad is added, require two quarter pecks of lime after each replenishing, and from two to three during each

period of working. The reheating should be done in the after part of the day, and the liquor, if every thing goes on regular, will be fit for work the morning of the second day afterwards. It is usual, in all regular dye-houses, to reheat on Saturdays in the afternoon, and again on Tuesdays or Wednesdays, according as the vat works. For the first ten reheatings, there is added at each half a hundred of woad, which makes the whole quantity used in one liquor ten hundred and twelve pounds of indigo for each of thirty-nine retreatings. So long as the woad is added, the vat will require, after the first days working, two quarter pecks of lime, and on the second evening, one quarter peck.

It will be seen that for working one vat during six months, there will be required half a ton of woad, and four hundred and ninety pounds of indigo. This vat, if skilfully managed, and prime indigo is used, will colour two hundred and twenty pounds of wool every week; and as it will admit of being worked six weeks after the last addition of indigo, there can be obtained from it, during the working down, four hundred pounds of dark blue wool, two hundred of half blue, and two of very light. This is the calculation in all well regulated English dye-houses.

A woad vat is liable to be out of order from two causes; from the lime being added in too great or too small a quantity, and although the causes of these defects are directly opposite, yet the first symptoms of the two bear so striking a similarity that it requires considerable practical skill to judge from which of the two it arises, and herein consists the whole difficulty of the business.—It is altogether a fermentative process, and there is but little doubt that the fermentation is of that kind which has been termed by modern chemists the panary, or that description of fermentation which produces yeast. I am convinced of this by the great quantity of carbonic acid gas that is liberated during the operation, and from the fact that acetic acid destroys the working of the vat, while yeast, bran, madder, malt, &c. promote it. At all events, whatever may be the stage of fermentation, it is necessary to keep

it always in one state, and this is regulated by quick lime. If too much lime is added, the fermentation will cease; the air bubbles, instead of forming a rich purple bede, will look white and burst with a hissing noise, and the liquor will feel slippery when rubbed between the fingers. Whenever a skilful workman perceives this coming on, he will stop working until the liquor is brought back to a healthful state. The safest way of doing this is to put into a hempen bag of coarse texture, one or two pecks of shorts, (according as the vat is more or less over-limed,) add an iron weight of fourteen pounds to sink the bag. The bag being tied up, is put into the vat, and the covers taken off to let the liquor cool to one hundred and ten degrees; in two or three days, and sometimes sooner, if the vat is not much over limed, the bag will rise to the top and give out a sour fetid smell. The liquor should now be examined, and if it has recovered its fine green colour, smells of the woad, and feels rough, the bag should be taken out and put on a plank over the vat until it has drained so as not to drip. The vat should now be covered down, and the heat of the liquor raised to one hundred and forty degrees. Let it be well stirred as soon as the heat is up, and if it does not show the usual appearances of a good liquor, add to it two or three buckets of the swill, and let it lie close covered for three or four hours, when it must be again stirred, and if not then at work add more swill, stir and add swill till it comes round. It will be necessary to watch it carefully as soon as it comes to a proper state of fermentation; for the means that has been used to force it will continue to operate so powerfully, that unless the fermentation is timely checked by giving it lime, the whole contents of the vat will be irrevocably lost.

When a vat is out of order for want of lime, the bubbles that rise will also be white and will fall with a hissing noise as before, but the colour and feel of the liquor will be different. The colour when overlimed will be of a light dirty looking yellow, and when underlimed, of a bluish green, in the first stages of falling off; and instead of being smooth, will feel rough when rubbed between the fingers. When it goes off from this cause, as much lime should be

added as will bring it back to a healthful state, and the liquor should be heated to 150° or 160° Fh. On adding the lime, put in a bucket of swill to revive the panary fermentation, which will have been injured by having gone too far. A vat set with a full quantity of strong woad will ever be liable to get out of order, but this will be mostly prevented by a skilful workman, provided he pays proper attention to the working of the liquor during the day and gives it a critical inspection when stirred in the evening.

A vat liquor that has been overlimed even to a great excess, may be brought back to a healthful state by cooling it down, and putting in bran bags, if care be taken to stop the fermentation with lime, when it comes too again; but when a vat is out of order, from not having been sufficiently supplied with lime, and this has been permitted, either from neglect or want of skill to proceed to an extreme deficiency, the fermentation will come on so rapidly, and in so sudden a manner, that, in a few hours, the bottom will swim on the top, and give out a strong fetid odour arising from a putrefactive fermentation having taken place. When this occurs, the contents of the vat is lost, and all attempts to revive it, will be only incurring expense without the least prospect of success. But such extreme cases never can occur where the workmen have had due practice, and are at all attentive to their business.

The vegetable ferments I have recommended to be used in a vat, are bran, cornell, madder, malt, and hops; but the materials that may be used, include all the ferments that are promotive of the panary fermentation, such as malt dust, distiller's swill, beer grounds, yeast, and ground grain of all kinds—it is useless, however, for a dyer to use too many, and in fact, cornell and madder will answer every purpose. No stronger proof can be given of the liability of mankind to be deceived, than the fact that a few years since, a work was sold, in a pamphlet form, in all parts of this country by a foreigner at fifty and even one hundred dollars each, professing to contain a substitute for woad, which, after all, proved to be nothing more than the swill I have before described,

that has for a long time been used by many woad dyers to promote the fermentation of their vats. However strange it may appear to intelligent persons, there are at this time a great many who firmly believe that a liquor from bran, madder, and hops possess all the virtue of woad.

It may not be amiss to recapitulate what has been said relative to the working of the woad vat, when every thing goes on in a regular way.

It is difficult to give directions, by which a vat of this kind may be worked regularly, as any little variation in the strength of the woad, or of the lime, will prevent it. The judgment of the vatman must therefore be exercised on all occasions, and lime and ferments added according to the situation of the liquor. The nearest rule that can be given, is the following:

A vat, as I have before stated, that is set with five hundred of strong woad will take ten quarter pecks of lime when brought to work, after working the first day, it will require two quarters, and after the second days working, one quartern. It has then to be renewed by adding twelve pounds of indigo, fifty-six pounds of woad, three pounds of madder, and one gallon of cornell, the heat being brought up to 150° Fh. before the ingredients are added. The vat to be well stirred after the ingredients are put in, and again at nine o'clock the same evening, also three or four times during the following day; at the last stirring, if the state of the vat should not require it sooner, add two quarter pecks of lime, also two after the first days working, and one after the second days. These directions are to be followed during every renewal so long as woad is added, but afterwards when only indigo and ferments are put in, one quarter peck after renewing, one quarter the first night after working, and half a one the second night, will be sufficient. When neither indigo nor woad is put in, that is, while the vat is working down, a still smaller quantity is requisite.

When cloth has to be coloured in the woad vat, it is first to be well scoured with fullers' earth, and then boiled with one and a half pound of cutbear for each end of twenty yards for one hour. The liquor being cooled down, the cloth is to be wound up on the reel and left to drain; the workmen then throws it on a hand-barrow, and carries it to the vat on which they lay the barrow, the cloth is lifted by the men into the liquor, one fold at a time, open and square, and a third person takes it in with two light sticks. In doing this, he must be careful not to let any air go down with the cloth. When the whole is taken in, it lies on the cross at one side of the vat, and the person who took it in, works it from side to side with a pair of hawks during thirty or fifty minutes, according to the depth of the colour wanted, and the strength of the vat. The hawks are made of iron, with sockets, which are placed in wooden handles about eighteen inches long. At the end of the sockets are iron rowels about the size of a cent, and nearly as thick, the rowels are notched, and with these the cloth is worked backwards and forwards. It is necessary to be very particular during the work that no air be admitted under the cloth, for when this occurs, it will leave light-coloured spots on it. The hawker must have considerable practice to perform this work with perfect safety.

It often occurs in England, that cloth is dyed in the flannel before it is fulled. When this is done, it must be well scoured in fullers' earth, after it has been boiled and the lists covered with webbing, and then worked in the vat after the same manner as the cloth. When it has been coloured, it is well washed, scoured in fullers' earth, and the webbing taken off. It is now fit for fulling. When fulled and cut to the furnace, the colour is made up to pattern in the vat, without covering the lists with webbing. If yellow list has been employed, its colour will be a lively green when finished, and it would require a good judge to distinguish the cloth from wool dyed.

RECEIPTS FOR DYING BLUE IN THE FURNACE.

THIS is often done for very common purposes, but never on any thing like fine goods. The following is the best receipt I have known for dying blue in the furnace, it is intended for twenty-eight pounds of stuff. Use

3 pounds of alum.
2 do. of cream of tartar.
2 do. of muriate of tin, (tin dissolved in spirits of salt.)
2½ do. of logwood.

Boil the wares one hour; heave in the cloth, and boil it one hour. When this has been done, throw away two-thirds of the liquor, and fill up with water—bring the furnace to a boil, and put into it one pound and three-quarters of chemick; let the liquor boil after the chemick is in fourteen minutes, cool down, enter the goods, and let them boil till of the colour wanted. This colour was of a beautiful dark blue, and stood exposure to the weather for more than a month before any sensible change took place, but in another month, some parts of it were changed to a dirty brown.

A blue may be made with logwood, by previously boiling the woollens, to be dyed, in copperas and blue vitriol; but this is so wretched a colour, and so very fugitive, that it would be unworthy of a place in a work professing to give instructions for dying of cloth. The process may be found in almost all the works on small dying.

Receipts for colouring a full navy blue, for mixtures, for sattinet, or other coarse work. It is for eighty pounds of scoured wool.

For the boiling use.

12 pounds of alum.
3½ do. of argol.

Boil these one hour, cool down, heave in the wool, and boil two

hours and a half; let it lie in all night. Prepare a fresh liquor, in which boil

18 pounds of logwood.
5 do. of peachwood (nicaragua.)

Boil the wares two hours, then the goods two and a half, and let it lie all night, wash, &c.

TO DYE BLUE ON COTTON.

I NEED not say much on this subject, as the vat for dying blue on cotton, is very well known in this country.

A vat of one hundred gallons is filled with soft water, into which put four pounds of the best indigo well ground; to each pound of indigo add two pounds of green copperas, and two and a half pounds of dry slacked lime. Add the ingredients in succession, as they have been mentioned, stir them together for half an hour and cover down, then stir frequently, and on the second or third day it will be fit for use; some persons add a little pot-ash, about half a pound to the quantity mentioned, but most dyers leave it out.

TO DYE BLUE ON SILK.

TO prepare the silk for receiving the dye, take twenty pounds of silk and boil it in a liquor with seven pounds of white soap, until the silk becomes white. Stick up, make a lather of warm soap liquor that is blued with indigo, give it a few turns in this, wring out, dry, and stick up. There should be three hanks on each string, and two strings are sufficient for one stick. It is now fit for dying, which must be done in the ash-vat to the pattern wanted.

TO DYE SILK A SAPPHIRE BLUE.

WASH the silk out of the suds after the boiling process last described, pump up a bath with cold spring water, put into it a ladle of alum liquor, (being from four to five quarts,) prepare half a pint of sulphate of indigo, or what is usually called chemick, of which add to the water as much as may be wanted to produce the intended colour, and as the silk will be of the colour of the liquor, there will be no difficulty in the operation. Colours may be died in this way from a pale to a dark sky blue.

TO DYE SILK A MAZARINE BLUE.

FOR this colour the silk must be prepared by boiling it in black soap; wash out of the suds and stick up. The colour has to be filled up with cutbear. Make a strong decoction of this by boiling it one hour, and strain the clear liquor through a sieve into a back. The silk has to be well worked in the cutbear liquor for a considerable time; wring out, head it off in seven or eight knots, and heave it into the blue vat till of the colour wanted. Wring out, well-wash, run it through a strong soap lather, wring out and dry.

TO MAKE SOAP LEES FOR PRODUCING THE LATHER.

TAKE lumps of lime that is strong and has been recently taken from the kiln; put a quantity into a lage butt, pour on boiling water, stir well and let it stand a week. Make use of this liquor to produce the lather with soap that is used for finishing the silk. It must always be used cold. Wherever directions are given for using a lather, after silk is dyed, it always refers to that which is here mentioned.

RECEIPTS FOR COLOURING OF RED.

MADDER reds are usually done on woollens after they have been fulled, as the soap used in fulling changes the colour of the red.—The cloths dyed madder red are mostly of a coarse quality, such as flannels, long baize, mocks for embossing, and army cloths for common soldiers. I shall give two receipts, one for a flannel, and another for a baize weighing fifty-seven pounds, and it will be easy for those who wish to dye red to add or reduce from the receipts according to the weight of the material they may want to colour.

Doctor Cooper asserts, p. 156, that "the solutions of tin give but dead colours with madder." This assertion of the Doctor's is very strange, for no madder red is ever dyed in England without the cloth being prepared with more or less of the solution of tin, and it is well known that the more is used in moderation, the better the colour will be. It is true the tin liquor is not used in the same liquor with the madder, but unless the cloth is prepared with this material before dying, the colour will not be a bright red, but rather of a brick colour.

FOR DYING A FLANNEL RED.

FOR each one, use in the boiling or preparation,

3 pounds of alum.
1 do. of argol, or tartar.
4 do. of tin liquor.

The ingredients are put into the water when it is boiling, and the goods are boiled two hour and a half; when taken out they should be thrown until they are as cool as is pleasant to the hands; they are then to be thrown into narrow folds, are rolled up close together, then wraped up in a thick coarse cloth, and left three or four

days, or until they become quite sour to the taste and have a sour smell. A fresh liquor must be brought on in which the goods are to be finished. When the water is near boiling, a gallon or two of bran are to be thrown in, which is to be scummed off just as it begins to boil. When the water is scummed clean, the heat must be lowered down to about 130° Fh. Let the madder now be put in and well stirred through the liquor, then the cloth must be rapidly entered and kept briskly turned over the reel and well opened all the time it is working. For each flannel of twelve pounds weight, use five pounds of the best crop madder. Soon as the cloth is in the furnace, put on the fire and bring the liquor to a spring heat in two hours, or about 206° Fh., then draw the fire and let the liquor cool down again for half an hour or more, when the colour will be finished. If the red should prove too yellow, put a small quantity of urine into the liquor, run the cloth again for ten or fifteen minutes, and it will be red enough. When the cloth is taken out of the furnace rinse it well in clear water till clean, and dry it in the tenters as soon afterwards as possible.

TO DYE A RED ON A LONG BAIZE WEIGHING FROM FIFTY TO SIXTY POUNDS.

For boiling use.

10 pounds of alum.
3½ do. of fine argol.
3 do. of tin liquor.

Boil the ingredients, as before directed, then the cloth during two hours and a half, wrap up and scour as before. For finishing, use twenty-five pounds of the best crop madder, and proceed as for flannels.

Receipt for a madder red for twenty yards of cloth, in which none of the tin liquor is used. These colours are of a dark rich red, but do not approach as near to the scarlet as either of the others.

For the boiling, use

4 pounds of alum.

6 ounces of cream of tartar.

Boil the wares as for the reds, run up, heave in the cloth, and boil it for two hours and a half—wrap them up, and let lay to sour. For finishing, use to to each yard nine ounces of the best crop madder in a fresh liquor. The cloth should be had in at a blood heat, and well reeled for six hours: by this time the liquor should just break out to a spring heat, the fire to be then drawn, and the cloth to run half an hour afterwards. Proceed as for the other reds.

Those who attempt to dye red on woollen must take care not to let the madder liquor boil, as the yellow of the madder will become fixed on the goods, and spoil the colour.

TO DYE RED ON COTTON.

IT is to be understood, that in the receipts I obtained from Manchester, for dying of cotton, there will usually be two given for producing each colour—the first will be for the best and most permanent colour, and the second, for such as are common and cheap.

Receipt to dye a fine and permanent red on cotton, in which there are five different processes.

First process. After the cotton has been well boiled and washed, dry, and divide it into handfuls of half a pound each; tie a

string round each parcel loosely, so as to leave room for the dye to penetrate under the strings. For each pound of cotton, take four ounces of well pounded nut-galls, boil them half an hour, or until the galls are soft, and for every pound of cotton, add five quarts of water. Take five quarts of this liquor, into which dip a pound of cotton, until thoroughly soaked, repeat the operation three times, then put the cotton into another tub, and pour the gall liquor on it—proceed in the same way with every pound of cotton, until all is done—let the whole lie till next morning. Then wring out evenly, so that the hanks may be equally pressed in all parts, then dry it. Warm the gall liquor, proceed as before, and let the cotton lie in another night, wring as directed, after the first galling, and dry.

Second process. To every pound of cotton, dissolve half a pound of fine pounded alum in five quarts of water, in a copper pan. When the alum is dissolved, add to every pound of it two ounces of pearl-ash—proceed in soaking and drying the cotton twice, as directed for galling; with this difference, that it lie in the alum liquor four or five days. Before maddering, put one pound and a half on each stick, wash it quite clean in running water, and wring well.

Processs the third. Take a tub large enough to wash the cotton in, fill it with warm water, and dissolve in it one ounce of pearl-ash for every pound of cotton, turn the cotton in as you would the yarn in the blue vat, work it in the liquor for fifteen minutes, wring out evenly, and it will be ready for the following process.

Process the fourth. Take a broad copper pan, large enough to hold for every pound of cotton, twelve quarts of water, put into this liquor one pound of the best crop madder for each pound of cotton, fill the pan within seven or eight inches of the top—when the madder is in, break the scum on the top, place the cotton on sticks, as before directed, and when the water is milk-warm, turn

the cotton in as in the blue vat—bring the liquor to a boiling heat in one hour and a half, but not to boil out—let it lie at that heat for fifteen minutes, then draw the fire, place the cotton hollow and straight, and let it lie so for an hour or more—then raise it out of the liquor and wring gently, shaking the madder well out of it, one string at a time—wash clean from the madder, and wring the cotton evenly and dry. In the summer dry it in the shade, in the winter in a stove.

Process the fifth. If the colour be not deep enough, take to every pound of cotton four ounces of brazilletto chips, boil them one hour and strain off the liquor into a tub, add to it urine or lime until the liquor has a pink cast. When the liquor becomes cool enough to bear the hand, put in the cotton and turn it over eight or ten times, then heave it out of the liquor and add for every pound of cotton half an ounce of alum dissolved in hot water, turn in eight or ten times, wring out and dry.

Receipt for a common madder red on cotton.

After the cotton has been well boiled and washed, use to each pound one and a half pound of galls, boil as before, turn in the cotton, squeeze out, turn in again, handle well and let it lay all night. Wring it out in the morning, and for each pound of cotton boil one pound of chipped brazilletto for half an hour, take off the clear liquor and add a little urine or lime till it has a pink cast, when a drop is let fall on the back of the hand; fill up the pan and boil the chips a second time for half an hour, proceed with this liquor as with the last, when it is so cool that you can bear the hand in it, dissolve for each pound of cotton two ounces of alum and add it to the liquor, mix well and turn in the cotton, work quick at first, then slower, turn down and let it lie one hour, then wring out and turn it in the liquor that was first boiled, work it well in this and turn it down for fifteen minutes, then raise out and wring a little to see if it be of the right shade; should it be too much on the

crimson, you must dissolve for each pound of cotton half an ounce of alum in the colouring liquor, turn in the cotton again and handle eight or ten times, wring out and dry, in the summer in the shade, in the winter in a stove, or warm room.

Receipt to dye silk of a blood red.

I cannot answer for this receipt; it was given me by a person who was a silk dyer, and as such I shall add it.

For each pound of silk take one pound of alum and a quarter of a pound of cream of tartar, boil them in a pail full of water for twenty minutes, let the silk steep in this liquor for two or three hours, take it out, rinse, and beat on a block, then hang up and dry.

Put four ounces of powdered Aleppo galls into a pail full of water, set it over the fire till the hand can just bear the heat, then put in the silk, let it lie two hours, take out and dry.

Put into a linen bag half a pound of ground Brazil wood, boil it in four quarts of bran water, keep the kettle covered while boiling, then take the kettle off the fire and let it stand all night, in the morning add to it a quarter of an ounce of pot-ash, boil it again one hour, then pour it into as much river water as there is liquor.

Take out the bag containing the Brazil, skim the liquor, and put in the silk; cover the vessel close and let it remain one hour, wring out and rinse very clean in river water, repeat the operation and dry it in the shade; if the colour be not strong enough, boil the dye again and repeat the operation. Pass the silk through a lather of soap and rinse in clean river water.

To dye yellow on wool and woollen cloth.

For a piece of Lancashire flannel. For the boiling, use

3 pounds of alum.
½ do. of tin liquor.

Boil the ingredients for half an hour, heave in the flannel and boil it two hours.

It must be finished in a fresh liquor with welds and a small quantity of pearl-ash. This is a very beautiful and highly permanent colour; the pattern I have by me is still very brilliant and full-bodied, though it was dyed more than twenty years since. Goods prepared the same as this in the boiling and finished in a separate liquor in a strong decoction of black oak bark, makes a fine yellow, but not of so fine a green tinge, nor so permanent as the weld.

To colour nine pounds of wool a fine yellow.

Boil with one and a half pounds of alum for three hours and let the wool lie in the liquor all night; take it out in the morning, wash and bring on a fresh liquor; finish with nine pounds and a half of welds, boil a quarter of an hour and let lie in all night.—Take out in the morning, wash, and dry it.

To colour eighty-five pounds of wool of a strong yellow.

Boil with ten pounds of alum, let lie in all night; take out in the morning and wash, then in a fresh liquor boil

30 pounds of weld.
6 do. of fustic.

Boil the ingredients in bags two hours, cool down, heave in the wool, and boil it one hour, run the furnace up till cool, land the wool, wash and dry it.

To colour one hundred and thirty pounds of list yarn a strong yellow.

For the boiling, use

18 pounds of alum.
2 do. of cream of tartar.

Boil the ingredients one hour, cool down, heave in the yarn, boil it two hours, and let it lie all night. Bring on a fresh liquor in the morning and boil fifty pounds of fustic chips in bags for two hours, lift the bags out, heave in the yarn, boil it one hour, land and wash, or if not strong enough in colour, let it lie in all night.

It is necessary, when yarn is dyed for list, that it should be pretty well alumed to prevent its fulling up faster than the cloth.

Three receipts for dying yellow on cotton.

The cotton for this colour must be very well cleansed previously to dying, and when bleached, it will take a fine colour. Whether it is raw or bleached, it must be boiled in the twisted hank, in soft water, until it sinks in the liquor, and must then be well washed. To prepare it for receiving the dye, boil it with six ounces of alum, and one ounce of verdigris for each pound of cotton—alum it twice, as directed, for red, and in the second aluming, let it lie four days. When it has been well alumed and dried, boil one pound of fustic for every pound of cotton, and make as much liquor as will soak the cotton twice—take half the liquor and turn in the cotton; when the colour is nearly drawn out of this, wring out, turn in the other half of the liquor, and when the colour is drawn out of that also, which it will be in about fifteen minutes, then wring out, and it is finished.

Second receipt for dying yellow on cotton.

When the cotton is dry, after aluming, take one pound of welds, and

one and a half ounce of pearl-ash to each pound of cotton—when this liquor has been well boiled, wring the cotton and turn it in at the usual heat for fifteen or twenty minutes, raise it out and dissolve one ounce of blue vitriol to each pound of cotton, put it into the former liquor, turn in the cotton for fifteen minutes, wring out, and it is done.

This colour will have a green cast, which is much admired; but if wanted of a golden yellow, it may be produced by boiling two or three ounces of annatto in a sauce-pan, with two or three ounces of pearl-ash, adding a very little of this solution to the weld liquor before putting in the cotton; but if too much of this be added, the yellow will be too brown.

Third receipt for dying yellow on cotton.

Let the cotton be boiled and well washed. Dissolve for each pound one ounce of alum, turn in the cotton, handle well, let it lie for half an hour, and wring out even. For each pound of cotton, use one pound of ground black oak bark, add to it one-eighth of an ounce of pearl-ash, and pour on it as much boiling water as will soak the cotton twice; stir these well together, take half the liquor, turn in the cotton at the usual heat, work it well and raise it on a pin. To each pound of cotton, dissolve one drachm of verdigris, add it to the first liquor, and turn in the cotton for twelve or fifteen minutes—wring out and give it the other half of the liquor, adding, after it has been dipped in this, the same quantity of verdigris as in the last, wring out and dry in the shade.

Receipt for dying yellow on silk.

Boil the silk in soap till white, wash it well out, and alum, wash it in two cold waters. Fill a furnace with clear soft water, put into it half a bundle of welds, and bring it to a spring heat, but not to boil out. Prepare a bath of clean soft water, and put into it of the yellow weld liquor to the colour wanted. If for a deep yellow,

make up and finish in a lather of soap; but if for a jonquille, this is not wanted—wring out and dry in a stove.

We began our dying receipts with black, and have proceeded to give directions how to make the dyers three primitive colours. Before giving receipts for making compound colours, we shall give instructions for dying white on woollens and silk, and stoving them.

Woollen cloth and cassimere are many of them coloured white for military uniforms and facings, and it is for such purposes most of them are used. White cassimere waistcoats, however, are not unfrequently used as well as white cloth pantaloons. Flannels are often whitened in the stove by sulphur bleaching.

Receipt for colouring one hundred and sixty pounds of cloth of an uniform white.

The cloth must be drawn over a perch to see that it is clear in the ground, and free from iron moulds, or any other stains that may be likely to show, when coloured. It has then to be well pized with fullers' earth, and afterwards looked over again to see if any defects make their appearance that were not before visible; and if any there are that will not discharge by rubbing with warm soap suds, the cloth will not be fit for whitening.

While the cloth has been preparing, a clean copper furnace, holding one hundred gallons of water, must be nearly filled and brought on to boil; whilst the heat is coming up, shave into it twelve or fourteen pounds of the best white soap, and bring it to boil. Care must be taken when it begins to boil, that it does not flow over the furnace, which it is very apt to do; to prevent this, keep a bucket of cold water by the furnace, and when you find that stirring with a rake will not prevents its rising, throw in the water. When the liquor has boiled a sufficient time to dissolve all the soap completely, take a bucket of the liquor, say three gal-

lons, mix it with three of soft water, and with it scour the cloth again in the stocks without washing out the soap.

Uniform whites may be coloured either in large wooden backs, or in a copper furnace, with a white willow basket made to fit the inside. Whatever vessels are intended for this purpose, they must be such as will not impart any stain to the goods, and must be kept clean and exclusively appropriated for that purpose.

When done in a furnace, it must be made very clean, and filled with perfectly clean water. A fire is to be put under, and the liquor raised to the temperature of new milk; at this heat as much of the boiled soap should be added, as will make the liquor very white; when this has been added, and the liquor stirred so as to mix the soap well through it, a small quantity of chemick is put in, just as much as will make the liquor of a sky blue, or darker, if the colour requires it. Uniforms are, some of them, of a natural white, when they require only soap and sulphuring, they vary from this to a very blue white, approaching to a faint sky colour—the latter are never sulphured. The blue mixture has to be passed through a bag—some stout flannel is sewed into the form of a jelly bag, and the top is secured round a wooden hoop. This bag is first wetted, and then placed in the furnace, the soapy liquor will pass through it, and fill the inside; into this part of the liquor, a small quantity of chemick is poured, and stirred in so as to be well mixed, the bag is drawn up by the rim, and the diluted blue permitted to pass through into the furnace—the whole is then well stirred with a rake, so as to mix the blue completely with the soapy liquor—the cloth is now entered, and rapidly moved over the reel, and kept well opened during the whole time of working. Have in at the heat of new milk, as before mentioned, and bring the heat up five or six degrees. In thirty or forty minutes, the colouring will be finished.

This colour is not washed, but the cloth is folded up carefully and smooth, and laid in a clean cloth, on a scrave, horizontally;

for if thrown across a dyer's horse to drain, the colour will run to the lists. When cloth has been dyed white, it is always stove dried.

On some occasions, the whites that are dyed without blueing, are hung up in a sulphur house to black. A sulphur house for cloth, is a square building, closely plastered, to prevent the sulphureous gas from escaping. The cloth is hung up by the list on wooden hooks, and no two folds are permitted to touch each other. The cloth, when hung up, should be thoroughly moistened with the whitening liquor, but not so wet as to run. When the house is filled with cloth, or the intended quantity is hung up, some roll sulphur bruised, is put on four iron dishes, which are previously covered two or three inches thick with fine dry silecious sand, on which the sulphur lies. One of these are put in each corner of the room, and a small hole is left at the bottom of the building near each pot, to admit a supply of external air for the purpose of keeping the sulphur in a state of combustion. When these are set on fire, the door is closed until the following morning, when it is thrown open, and as soon as the workmen can enter with safety, the cloth is shifted, the list that hung down, being now turned up and hooked on the tenters—more sulphur is now placed on the sand plates, which is ignited as before; and when the cloth has undergone this second process, it is finished sulphuring, and will have to be tentered and dried.

It is necessary to observe, that cloth intended for uniform white, is finished shearing before it is coloured, and that after dry, it need only be beaten in the tenters, with small white willow rods to extricate any soap that may hang on the face in a state of dust, the beating should be done very lightly. Sometimes a small quantity of the best whiting is used in the soap liquor, but this is seldom necessary.

ON COMPOUND COLOURS.

HAVING given receipts, and the modes of working for black and white, and for the dyers three primitive colours, blue, yellow and red, we will proceed to the compound colours, and shall begin with those that are compounded of blue and yellow constituting all that genera known by the name of green. I shall, that my directions may be more clearly understood, divide this genera into four distinct classes: the true green, those colours which are died with blue and yellow alone, in which neither of those colouring matters predominate in any considerable degree, into yellow green, in which the yellow predominates; into blue greens, in which the blue has the ascendency, and, finally, into those greens into which the red enters into the composition.

When cloth has to be dyed green, it must previously be well pized with fullers' earth.

Of true green.

The following receipt is for a full bodied colour of this kind, on thirty-three yards of seven-quarter Spanish felt, weighing about forty-six pounds.

For the boiling, use

8 pounds of alum.
1 do. of chemick.

Boil the alum and chemick for half an hour, then heave in the cloth and boil it one hour, take it out and boil in the same liquor

30 pounds of chipped fustic.
5 do. of alum.
3 do. of chemick.

Boil the alum and chips for one hour, then add the chemick, pouring it into the boiling liquor in a small stream, not more than the size of a wheaten straw, to prevent its blowing out; let the liquor boil ten minutes, fill the furnace with cold water to the proper height, stir the liquor well with a ra[illegible]oth and rattle

over the reel as fast as two men can open it, for unless this be rapidly done, the colour will be uneven, as the blue strikes instantly. Bring the furnace on to a boil and keep it boiling till of the colour wanted.

In colouring of green, when chemick is used, it is essential to know that the goods take the blue first and then the yellow, and that the longer they are boiled the yellower the colour will be.—Therefore in dying two or three pieces at once, as many different colours may be taken successively out of the furnace.

When the desired colour is obtained, the cloth should be wound upon the reel rapidly, and immediately thrown off into a back of clear cold water. It must then be cleaned by streaming, as directed under the article cleansing of cloth.

For a very light grass green for about forty-one pounds of cloth,

Put into the water before it boils a quarter of a peck of bran and one pound of tin liquor, bring the liquor to a boil, and when slowly boiling scum off the bran as it rises. When the liquor has been well scummed, add

7 pounds of alum.
1¼ do. of chemick.

Boil the alum half an hour, then add the chemick and boil ten minutes; run up the furnace, stir well, heave in the cloth and boil it one hour. In the same liquor boil

10 pounds of fustic.
1½ do. of chemick.
2 do. of alum.

Boil the fustic and alum as in the last receipt, and add the chemick as there directed and boil as usual; stir the liquor well, heave in the cloth, boil till of the desired colour, cool down, and heave out in a back of water. When finished, proceed as with the last.

Very permanent greens of any colour may be made on cloth by bluing it in the woad vat to the colour wanted, then making a liquor with one-sixth of its weight of alum, and as much fustic as will make the desired colour.

For dying wool a true green.

For a full bodied dark green on two hundred and three pounds of wool. To be first dyed a middling blue in the woad vat, then to be finished in the furnace with

80 pounds of fustic.
20 do. of welds.

The fustic to be boiled by itself two hours; the welds to be entered and boiled twenty minutes. The dye wares are now to be taken out, the furnace run up, the liquor well stirred, the wool entered and well handled, as before directed, for half an hour, the heat to be brought on and boiled two hours. The furnace must now be run up with cold water, and four pounds of alum strewed over the liquor by handfuls at a time, the wool being well raked over and briskly handled at the time, and between the throwing on of each handful; when the alum is all in, put on the fire and keep handling until the liquor begins to boil, permitting the liquor to boil for half an hour, then open the furnace door and let it lay all night.

It must be noted that wool should never be landed out of a very hot liquor, for this makes it stringy and difficult to work in the machines. When a large furnace of liquor has lain with the wool in it all night, it will be about cool enough to run off in the morning; should any circumstance make it necessary to run off immediately after it has boiled, the liquor should be cooled down to 140° Fh. before the wool is left free of liquor. To perform the running off, without permitting any wool to go with the liquor, let the workman, before turning the cock, thrust the wool from before the opening with two or three large sticks; when this has been done effectually, put a circular shovel between the sticks, and before the

opening to the cock, by which means the liquor will be permitted to run off freely without any wool following it.

For a true green, the wool to be coloured in the vat as before. The colouring materials prescribed in this receipt is for twenty pounds of wool.

4 pounds of weld.
9¾ do. of rasped fustic.
¾ do. of logwood.

The materials to boil one hour; the bags taken out; the liquor run up with cold water; the wool had in, and boiled two hours, then strew over two pounds and a quarter of alum in the same manner as directed for the last; boil again for half an hour, and let lay in all night.

For a very light true green—to be first dyed a very light blue.

It must be understood that in all cases when a furnace colour is done on a blue ground, and particularly when the colour is light, the blue must be washed very clean before it is dyed, otherwise the colour will have a very dull and muddy appearance when finished.

This light colour has first to be boiled in four pounds of alum for every twenty-four pounds of wool, and let lay in the liquor all night, and then, without washing the wool, bring on a fresh liquor, in which boil sixteen pounds of weld, run up, heave in the wool, boil two hours, and let it lie in all night.

This receipt makes a very bright beautiful green, being much like that which is seen on the plumage of a peacock.

There is no dying drug that produces so fine a yellow as weld, and it imparts a softness to the wool that no other appears to give.

For a true green for two hundred pounds of wool. To be woaded as usual.

For the boiling, use
30 pounds of chipped fustic.
50 do of welds.

The dye wares to boil two hours in bags, as usual—the furnace run up and well stirred, the wool heaved in and boiled two hours, then cool down, and strew over

10 pounds of fine pounded alum.
1 do of do green copperas.

After these are in, and the wool well handled, bring the liquor to a boil, and let it lay all night.

Receipts for green in which the blue predominates.

There will be no occasion to give any receipt for making this colour on cloth, as they may be easily made by lessening the quantity of fustic, and increasing that of the chemick, upon any of the receipts for true greens.

To dye one hundred and fifty pounds of wool, in which the blue slightly predominates.

To be first dyed blue in the vat, such as can be done for ten cents per pound—then boil sixty pounds of fustic chips, in bags, for two hours—take the bags out, run up, heave in the wool, and boil it two hours—then run up again, and strew in nine pounds of ground logwood, and one pound of pulverized blue vitriol, boil two hours, again cool down, and strew in one pound of alum, and one pound of green copperas, boil one hour, and let lay all night.

Receipt for a blue green, where the blue is stronger than the last—for two hundred and forty pounds of wool. Dye in the blue vat to a fifteen cent blue.

For the boiling, use

66 pounds of chipped fustic.
20 do of welds.
1½ pint of chemick.
1 pound of pearl-ash.

Let the fustic boil in bags two hours, then heave in the weld in bags, and boil half an hour; take out the dye wares and put in the chemick as directed for cloth—when this has been boiled, add the pearl-ash in small quantities at a time, then run up and stir well, after which, heave in the wool rapidly and handle very quick—boil two hours, run up and strew over eight pounds of argol, and twelve pounds of alum—boil one hour, and let it lay all night.

For a very light blue green, for sixty pounds of wool.

14 pounds of weld.
3 tea cups full of chemick.

Cause the welds to boil half an hour, then take out, and add the chemick, as before directed—the liquor must now be run up, the wool heaved in, and handled quick: then boiled two hours and cooled down—when this has been done, strew over six pounds of pounded alum, and three pounds of argol—boil one hour and let it lay in all night.

In the two last receipts for wool-dyed greens, the blue is made with chemick. Although I cannot recommend those who are desirous of obtaining credit in the market, to dye their greens in this way, yet as it is a cheaper mode than when the blue is made in the vat, it is not unfrequently so done.

Receipt for a very dark green, a little inclining to the blue, for two hundred and thirty pounds of wool, previously dyed a fifteen cent blue, in the woad vat.

For the boiling, use

86 pounds of chipp'd fustic.
30 do. of chipp'd logwood.

The wares to be boiled in bags two hours, the liquor run up, well stirred, and the wool had in. Let it be one hour coming to a boil, and boil two hours—then cool down, and strew over ten pounds of alum—boil half an hour, cool down again, and add four pounds of copperas, and one pound of pearl-ash, boil one hour, and let it lay in all night.

For one hundred and forty-eight pounds of wool for a dark blue bottle green—to be first dyed in the woad vat to a thirteen cent blue.

13 pounds of umbro madder.
130 do. of logwood.

Let the wares be boiled two hours, the liquor cooled down, well stirred, and the wool entered—then the liquor is to be boiled three hours, and when it is cooled down, strew over it four and a half pounds of alum, and thirteen pounds of copperas—boil half an hour, cool down, and let it lay all night.

For a middling blue green for two hundred and five pounds of wool—to be first woaded a nine cent blue,

21 pounds of alum.

Boil this half an hour, run up, heave in the wool and boil it two hours—then heave out and wash. Prepare a fresh liquor, and boil in it

40 pounds of chipped fustic.
7 do of umbro madder.

Boil the wares two hours, cool down, heave in the wool and boil it three hours—let it lay all night.

For a very light green in which the blue predominates—for fifty-six pounds of wool first woaded to a four cent blue, use

9 pounds of fustic.

Let the wood be boiled two hours, the bag taken out, the furnace run up, the wool heaved in, and boiled three hours, and let it lay all night.

Receipts for greens in which the yellow predominates.

In these will be included bronze and olive greens. Bronze greens are those colours which are of a rich olive, having a very strong body of yellow.

For a rich bronze for two hundred pounds of wool, that has been coloured a full twenty cent blue.

80 pounds of chipped fustic.
50 do. of welds.

Let the fustic boil two hours, then heave in the weld, and boil half an hour—take the wares out of the liquor, stir, heave in the wool, and boil it two hours—then cool down and strew over it ten pounds of pounded alum, and one pound of dissolved copperas—let it now boil one hour, and let it lay all night.

For a bronze on two hundred and sixty pounds of wool.

This is for a rich and very full colour. It has first to be dyed in the vat of a light seven cent blue.

For the boiling, use.

130 pounds of chipped fustic.
70 do. of weld.
4 do. of chipped logwood.

Let the ingredients be boiled as before, for two hours, the furnace

run up, well stirred, the wool heaved in and boiled two hours—then cool down, strew over it twelve pounds of alum and two pounds of argol, or cream of tartar; boil again one hour—let the liquor be cooled down a second time and strew over it nine pounds of dissolved copperas, and one of ground logwood—let the liquor boil one hour, and the wool lay all night.

For one hundred and sixty pounds of a lighter bronze, and not so yellow as the last.

This has to be woaded to a light fourteen cent blue.

For the boiling, use

64 pounds of chipped fustic.
40 do of welds.

The wares to be boiled two hours, the bags taken out, the liquor cooled down, well stirred, the wool heaved in and boiled one hour and a half—then cool down, and strew over it eight pounds of pounded alum; boil one hour, cool down again, and strew over it from half to three-quarters of a pound of dissolved copperas—boil three quarters of an hour, and let it lay all night. This is called an emerald green, and is a very beautiful colour.

For a fine olive green. For two hundred pounds of wool woaded to a nine cent blue, use for the boiling,

190 pounds of chipped fustic.
45 do of weld.

Boil the fustic two hours, then the weld half an hour; take out the dye wares, run up with water, stir well, heave in the wool and boil two hours—then cool down and strew over it ten pounds of alum and two pounds of dissolved copperas—boil one hour, and let it lay all night.

For a dark bottle green of the bronze hue, for one hundred and forty pounds of wool, made a full eleven cent blue.

For the boiling, use

80 pounds of chipped fustic.
15 do. of welds.

Boil the wares as before, cool down, stir well, heave in the wool and boil two hours—then cool down, and strew over it seven pounds of pounded alum, and three pounds of madder—boil one hour, and let it lay all night.

To dye bottle greens of different shades, take from

Wares for each score of wool.	4 to 10 pounds of fustic. 3 to 12 do. of logwood.	for the boiling.
	For saddening.	
	1 pound of alum. ½ do. of copperas, more or less.	

The wool to be died to a fourteen cent blue, and proceeded with as directed for other greens.

To dye red greens.

For all greens intended to have a red hue, take any of the foregoing receipts, leave out one-third of the yellow dyes, and add from one to three pounds of barwood or camwood. As much madder would be still better than the woods.

We have now gone through all that will be necessary for colouring of greens on wool and woollen cloth, having given ample directions for each class of this colour, and shall now proceed to give receipts for producing greens on cotton and silk.

The two following receipts are for dying green on cotton.

Cotton for this colour must be well boiled in a solution of pot-

ash, then washed and dyed blue, to the shade wanted in the copperas vat. When it comes from the vat, dry it, wash a little, and dry again—then alum as for red, with six ounces of alum to the pound of cotton, dry and wash it. Boil eight ounces of fustic for each pound of cotton; when well boiled, take out the liquor, put it in a proper tub, and when you can bear the hand in it, put in the cotton and turn it eight or ten times; then raise it out of the liquor and dissolve one ounce of blue vitriol for each pound of cotton, put it into the fustic liquor, turn the cotton in, and work it round eight or ten times—then turn it down, and let it lay for twenty or thirty minutes—wring out, dry and wash, and then it is finished.

Second receipt in which part of the blue is directed to be put on with logwood, is cheaper.

Boil the cotton well, wash and give it a light ground in the cotton blue vat—boil one pound of fustic and four ounces of logwood to each pound of cotton, after boiling well, take off the clear liquor, and when you can bear the hand in it, turn in the cotton several times; then turn it down into the liquor for half an hour—raise out on a pin and let it drain. Dissolve for each pound of cotton half an ounce of verdigris, or of blue vitriol, pour it into the liquor, stir well and turn in the cotton as before, wring out and dry in the shade. By adding or diminishing the logwood and fustic, any shade of green may be obtained.

To colour cotton permanent olive.

It is not requisite that the cotton be bleached for this colour, but it must be well cleansed. To each pound of cotton, take three-quarts of water, one ounce of argol, one and a half ounce of copperas, half an ounce of sugar of lead, and two ounces of blue vitriol, dissolve these together in the warm water; when dissolved, add one ounce of pounded whiting a little at a time; take of the clean liquor, and turn in the cotton, work well, wring out and turn in again, and let it lay all night—in the morning wring

out, dry and wash. Boil for each pound of cotton one pound of fustic, turn in the cotton, wring out, wash, and dry. It is now finished, but if wanted darker, a little sumac will deepen the colour. It may be made lighter or darker, by adding or diminishing the copperas. If the drugs be dissolved in logwood water, the olive will be greenish.

To colour cotton a common olive.

For this colour, the cotton is began and worked exactly the same as for chocolate; but instead of brazilletto, you must give it fustic liquor, in which well work it. For a greenish olive, dissolve for each pound of cotton, one ounce of alum; for a yellow olive, half an ounce of blue vitriol, if for a very green olive, add a little logwood liquor, and when it has been well worked, wring out on a pin, and give for each pound, half an ounce of blue vitriol, let it lay in this for half an hour, turning it now and then—wring out and dry.

To colour silk green.

To colour silk a permanent green, it is previously yellowed with weld and alum, and made to the pattern wanted, in a blue vat: either the woad or ash vat will answer.

For a Saxon green.

Wash out of soap suds and stick up. Boil ground green ebony in a copper vessel, strain off into a tub through a sieve, add chemick to the colour wanted. To be used with very little heat, wash in two cold waters, wring out, hang up and dry.

To colour silk a dark olive.

Boil with coloured soap, and wash well out—allum and well wash—put into clear warm water half a ladle of strong fustic li-

quor, and the same quantity of strong logwood liquor, give the silk a few turns in this, and it will be a good olive. If wanted greener, use a little blue vitriol, wring out and lather. When the olive is wanted to be of a brown hue, it will do without a lather.

Having given an assortment of receipts for all those colours that is the product of blue and yellow, we shall now proceed to that class of colours that is the product of yellow and red, which will include scarlets, buffs, oranges, auroras, wine colours, and a certain class of browns, &c. &c., for which receipts will be given in the order they are here mentioned.

Of scarlet.

I have already given directions for preparing the tin liquor; and those who are desirous of having their colours uniformly of the same brilliant hue, must be particular in following one uniform mode of preparing their tin liquor, as the least variation in this particular, will make a sensible difference in the colour.

I shall give two receipts for producing scarlets from my father's practice, one as it was done thirty years since, and the other of modern date. A third will be given, called Nash's scarlet. The receipts will be given for a certain number of yards of broadcloth, each yard weighing about one pound, six or seven ounces. I have already described the kind of cochineal that must be used to produce the best colours, and that when sylvestre is used, those samples having the largest grains, with the least white or grey down on them, and which are the least adulterated, should be preferred.

It will be necessary to give directions for the workmanship, before giving receipts for dying.

In dying of scarlet, the furnace, if of copper or brass, must be kept very bright and clean. If of block-tin, the liquor may be

permitted to remain in the furnace from one day to another; but when of copper or brass, it must be emptied every night, scoured quite clean, and fresh liquor made the succeeding day. This direction has to be observed for all colours where solutions of tin are used as well as for every other delicate colour.

A willow basket, such as I have before described, is used in all these colours. It is also necessary to cover the curb with clean white canvass, to prevent the goods dyed from receiving any stain from it. The canvass should be secured to the top of the basket, and hang over the outside of the curb, against the furnace, for six or nine inches. The reel should be made of clear white pine, free from knots, the broading and stopping sticks should be of dry white ash, without bark. The cloth, after having run its proper time in the furnace, should be rapidly wound up on the reel, and immediately thrown off into a back of cold spring water. The back should be of an oval form, about three feet over in the centre, as long as the cloth is wide, and be made of some clean white wood that will not impart any stain to the cloth. The cloth is moved rapidly over the reel all the time it is in the furnace, and must be kept well opened by the broads-men. The liquor is brought to boil as soon as possible after the cloth is entered, and kept boiling rapidly until the colour is finished. When taken out, it is immediately streamed, as before directed, until quite clean, and tentered as soon after as possible.

Before a new made liquor begins to boil, and prior to any thing being added to it, throw into the furnace one pint of tin liquor, and two or three quarts of bran, bring the liquor to boil, which will cause the bran to rise to the top, let this be scummed clean off with a fine sieve, and the liquor will be ready for use.

The cream of tartar and other drugs used for this colour, should be ground or pounded very fine.

For dying two pieces of seven quarter Spanish felt, measuring thirty-seven yards each, and weighing about one hundred and seventeen pounds.

Use for the boiling,

3 pounds of clean white alum.
2½ do. of turmeric.
2½ do. of cream of tartar.
6 pints of tin liquor.
1½ pounds of cochineal.

The alum and tartar to be first boiled about five minutes, then the solution of tin to be added and boiled two minutes, then add the turmeric and cochineal, and boil ten minutes. Cool the liquor down, stir well, and enter the cloth rapidly, put on the fire, and bring the liquor to boil as soon as possible—keep it rapidly boiling during one hour, cool the liquor down, reel the cloth up the winch, and heave it out in the back, as before mentioned—then let the cloth be well streamed, and while that is doing, add to the boiling liquor,

1½ pounds of cream of tartar.
4¾ do. of cochineal.
6 pints of tin liquor.

Boil the cream of tartar and tin liquor four or five minutes, put in the cochineal and boil five minutes, cool down, stir well, and enter the cloth, taking care to keep it in rapid motion, and well opened, all the time of going; boil for thirty or forty minutes, cool down and heave out in the back, as before. The girtweb has now to be taken off the lists, the cloth streamed until thoroughly cleaned, and then tentered as soon after as possible.

Scarlets dyed, according to the last receipt, were rich and full bodied, but were not of that fine flame colour which is required by the fashion of the present day. When alum is used with cochineal, it increases the body of the colour, and gives it a blue tint approaching towards a pink colour.

For dying seventy-six yards of seven-quarter Spanish felt, a fine flame coloured scarlet, such as is now in demand, weighing one hundred and twenty pounds.

Use for the boiling,

3 pounds of cream of tartar.
2 do. of turmeric.
6 pints of tin liquor.
2 pounds of cochineal.

Put these ingredients into the liquor, successively, as directed for the last, and when the last is in, boil ten minutes, cool down, stir well and heave in the cloth rapidly; boil one hour, cool down and heave out, as before directed. Let the cloth be well streamed, and whilst that is doing, bring the liquor on to a boil, and add for the finishing

3 pounds of cream of tartar.
2 do. of turmeric.
6 pints of tin liquor.
5 or 6 pounds of cochineal.

Put the ingredients in as directed for the boiling, cool down, stir well, heave in the cloth and boil rapidly, from thirty minutes to one hour, according to the colour wanted—heave out in a back of water, and proceed as before.

A manufacturer of the name of Nash, became celebrated for dying of scarlet, and the colour has taken its name from him, being called Nash's scarlet. The principal difference, however, between his colour and others, is, that the cloth dyed by him was well grounded, the colour having completely penetrated through the thread of the cloth; and this advantage was more the result of a peculiar mode of making the goods, than of any superiority in the dying. The warp, as I have been informed, was spun with as little twist as would answer for weaving, and the filling as loose as it could be spun, so as to follow the shuttle. A gentleman, who was a late partner of Nash's successor, is now in Virginia.

For dying a Nash's scarlet on two pieces of thirty-two yards, each weighing ninety-six pounds.

This colour has two boilings before the finishing operation, and must be considered as in imitation of Nash's dying.

For the first boiling, use

1½ pounds of cream of tartar.
4 pints of tin liquor.
1½ pounds of fine argol.
1 pound of turmeric.
1 do. of cochineal.

Boil the ingredients as before, cool down, heave in the cloth and boil one hour. It has to be boiled a second time without streaming, only previously cooling the cloth by throwing it backward and forward.

For the second boiling, use

8 ounces of turmeric.
4 pints of tin liquor.
3 pounds of cream of tartar.
1 pound of cochineal.

Proceed as before, boil two hours, heave out and stream well—then use for finishing,

5 pounds of cochineal.
6 pints of tin liquor.
2 pounds of cream of tartar.

Heave in the cloth, as before, and boil till done, which will be in thirty or forty minutes. This is a strong rich colour, and being boiled two hours in the second process, and the yarn having been spun loose, is so much better grounded than scarlets commonly are, as to give the colour an appearance of great intensity.

It is usual in all establishments where scarlet dying is carried on upon a large scale, to colour twenty or thirty pieces in one day,

and by this means, much expense is saved. If a furnace is brought on early in the morning, some pieces are boiled in the first operation, this prepares the liquor for finishing; three or four lots that were boiled a day or two before, are then finished in the same liquor, and afterwards three or four lots of white pieces are boiled. The first lot boiled after finishing, needs no cochineal, the others follow it until the whole of this valuable drug is taken out of the finishing liquor—tin liquor, cream of tartar, and turmeric, are added in the quantity prescribed; but no cochineal, excepting for the second boiling—the third and fourth lots are called runs, and are boiled a second time. Sometimes a whole day is employed in boiling, when the practice prescribed, in the receipts given for boiling is followed, excepting for the two last, in which the cochineal is left out.

To colour scarlet with the colouring matter of shell lac, known by the name of lac lake.

I have two receipts for this colour, one that was obtained from the specification of the patentee, and the second from a relation who used it in dying of scarlet worsted for manufacturing of worsted webbing.

In the first the lac spirits has to be prepared by dissolving four ounces of tin in a pint of spirits of salt, which must be performed by digesting the mixture in a sand heat. The following compost has then to be made: to ten pounds of lac spirits, put six pounds eight ounces of lac lake powdered fine, six pounds eight ounces of ground cream of tartar, four ounces of pounded turmeric, eight ounces of cochineal, one pound of safflower, and four ounces of diluted oil of vitriol.

One pound of said mixture to be used to produce a scarlet on two pounds of woollen yarn or cloth.

In the second they take three and a half pounds of lac spirits, in

which is put two and a half pounds of pounded lake, and three pounds of cream of tartar, which is well mixed at least twenty-four hours before using it. This quantity is employed to colour twenty pounds of worsted.

As cotton is never dyed scarlet, we shall proceed to silk.

Boil twenty pounds of silk in a liquor with four pounds of black soap for three hours. Take any quantity of annatto, ground fine, to each pound of annatto, add four ounces of pearl-ash, these are to be ground together in a copper pan, with copper balls similar to indigo. Bring your water to a boil, take of the annatto liquor one or two bowls, which add to the boiling water, put your silk in at a spring heat, and it will soon become a good orange. Take the silk out of the furnace, hang it up over it, so that the liquor which drains off may return into the furnace. When drained, wash the silk in four warm waters and hang up six knots on each stick. Take of tin liquor one pint, add it to water of a good heat, and this will be sufficient for ten pounds of silk, give a few turns, wash out and stick up. Then take one and a half pounds of well ground cochineal, put it into a bell tub, and fill it up with boiling water; give the silk a few turns in this, and it will come out a fine scarlet, which, in England, is usually charged two dollars per pound.

To dye a mock scarlet on silk.

Orange the same as for real scarlet, wash and stick up as before. Add some strong alum liquor to boiling water, turn the orange in this liquor for three hours, wash in two cold waters and stick up. Take of a liquor made from Brazil wood, previously boiled, two pails, soak sumac in a tub and strain off a ladle full. These two will finish off the orange a good mock scarlet. When dark enough wring out and dry.

RECEIPTS FOR BUFF.

THE yellow for dying of buff is obtained from fustic. The best sticks used are such as are new and sound, being selected for this purpose. The outside of the logs are split off, and the heart of the wood is ground very fine and sold to the dyers at double the usual price, for dying of buff and other fine colours. A good buff dyer is more rare than a good scarlet dyer, and goods for this colour are sent from London and other parts of England, a distance of more than one hundred miles, to a dyer in the west of England, who is celebrated for dying this colour. It would be supposed that a colour requiring only fustic, yellow, and a little best madder, could be well done any where, did not experience prove it to be erroneous.

The cloth intended for buff must be examined, spotted and cleaned the same as for scarlet, and that which is not perfectly free from spots and stains cannot be used for this colour, as the least defect will be seen when finished. Cloth for buff must be finished shearing before it is dyed.

The same precautions to keep the goods from coming in contact with the metal and curb of the furnace, are used in this colour as in the scarlet dye. Buff is more liable than any other colour to become spotted when it comes in contact with any material that can impart a stain to it, the utmost caution, therefore, should be used to prevent this.

For twenty-seven pounds of fine cloth, use

1 pound of argol.
1 do. of alum.
2 do. of tin liquor.
½ do. of ground fustic.
1 ounce of best crop madder.

Boil the ingredients as directed for scarlet, heave in the goods, keep them rapidly in motion, and boil till of the desired colour. If this colour should not be strong enough, use more fustic and madder; if too red, use more fustic and less madder; if not red enough, use more madder and less fustic. By these means any body or shade may be obtained.

I have never known wool to be dyed buff and made into cloth for one uniform colour, but as it is often made for mixtures and for striped goods, such as vest patterns, &c. I shall add a receipt to produce it.

For a buff on one hundred and twenty pounds of wool.

Take fourteen pounds of weld, boil it half an hour, take out the welds, stir well and heave in the wool—boil it two hours and land—add to the liquor one pound of alum, cool down, heave in the wool, boil it one hour, land and wash.

This will be a pale yellow buff, the shade of which may be changed by using a small quantity of madder.

Buffs may be coloured on wool with fustic and madder, as it is done on cloth, leaving out the greater part of the tin liquor, which, when applied strong, makes the wool harsh and difficult to spin.

For a buff colour on cotton.

Cotton for buff should be bleached. For each pound of cotton take one quart of iron liquor, (acetite of iron,) and four of water—put it into a copper or brass vessel, add to the iron liquor six ounces of copperas, and one ounce of sugar of lead; when you can bear the hand in the liquor, turn in the cotton, work it well, squeeze out, and turn it in again, then let it lay all night, taking care that the cotton be completely covered with the liquor. In the morning wring it out, and dry quick, spreading it well on the drying poles.

Take fresh made lime-water, turn in the cotton as quick as possible, and wet it completely. When raised to the colour wanted, wring out, wash, and it is finished. If the colour should not be full enough, put in more iron liquor and copperas, and less water. If it be too strong, put in less of those ingredients, and more water, by which means a great variety of shades may be obtained.

For a salmon colour on cotton.

The cotton must be white--prepare as usual. Boil for each pound of cotton, one ounce of cream of tartar, for fifteen or twenty minutes, add to it water enough to turn in the cotton, work it for half an hour, and wring out. Then turn it into a liquor prepared the same as for orange, only about half the strength, work quick and even, when well worked, wring out evenly, and turn it into the cream of tartar liquor again, work quick until it receives a nice salmon colour—wring out and dry in a warm room.

For a brimstone, or straw colour, on cotton.

The cotton must be white. To each pound, dissolve one ounce of alum, turn in several times, and then turn down for half an hour, wring out gently and even. It must now have a clear and slender fustic liquor, turn it over quick at first, and turn it into the alum liquor again ten or twelve times, wring out evenly, dry in a stove in the winter, and in the shade in the summer.

For a straw colour, on silk.

Boil till white, and wash, wring out and stick up. Prepare a strong ebony liquor by well boiling, take a ladle of this liquor, which will dye about ten pounds, give it five or six turns in this when diluted with water, and if the ebony does not work green enough, put into the liquor a very small quantity of chemick, and finish by stoving with sulphur.

Receipts for orange and aurora.

When woollen yarn and cloth are dyed orange or aurora, they are usually boiled in a spent liquor, after scarlet or buff.

For one hundred pounds of cloth for a fine orange. Boil in an old buff liquor

12 pounds of young fustic chips.
4 do. of best madder.
6 do. of cream of tartar.
2 pints of tin liquor.
2 ounces of cochineal.

The chips to be well boiled before the other ingredients are added; after boiling the other wares for a few minutes, cool the liquor down, stir well, heave in the cloth, and boil till up to the pattern.

For an orange on sixty pounds of fine cloth, in a spent scarlet liquor.

8 pounds of young fustic chips.
4 do. of cream of tartar.
3 do. of best madder.
½ ounce of cochineal.
1 pint of tin liquor.

Boil the chips, and proceed as before.

Auroras are dyed the same as oranges, excepting with less madder and an additional quantity of cochineal. Some auroras approach very nearly to the scarlet colour, having a greater body of yellow.

Oranges and auroras, when done in a liquor prepared on purpose, require more cream of tartar, tin liquor, and cochineal, than is prescribed in the foregoing receipt.

For a common orange, on four pieces of flannel.

For the boiling, use
1 pint of tin liquor.
2 pounds of argol.

Give a body with young fustic, and redden to pattern with madder.

Wool is seldom dyed of an orange colour, but as it may be wanted sometimes for mixtures, I will give the only receipt my collection affords.

For an orange on nineteen pounds of wool.

Take three pounds of alum, boil it one hour, cool down, stir, heave in the wool, boil two hours, and let it lay all night. In the morning wash it, and finish in a fresh liquor, with ten pounds of weld, and three pounds of madder, boil seven or ten minutes, and land.

For an orange on cotton.

The cotton for this colour, should be white. To each pound of cotton, take two ounces of annatto, grind with water in a brass kettle, as indigo is ground, wash it out into a kettle, or pan, and add an equal quantity of pearl-ash—boil for half an hour, turn in the cotton, wring out, and dry in a stove, or in the shade—the more of dye is used, the richer and finer will be the colour. The liquor should not be thrown away after the working, but used with another quantity, by adding more of the material to the old liquor after boiling, which will be a saving of one-third.

TO DYE CINNAMON COLOURS.

For fifty pounds of fine cloth for a bright cinnamon, use

7½ pounds of alum.
1½ do. of argol.
9 do. of redwood.

Boil the wares two hours, cool down, stir, have in the cloth and boil one hour.

For a darker cinnamon on the same weight of cloth, use

7 pounds of alum.
2 do. of argol.
6 do. of fustic.
10 do. of barwood.
8 do. of redwood.

Boil the wares two hours, have in the cloth, and boil as before.

The hue and body of cinnamon may be varied by using more or less of fustic, and of the other dye woads.

Cloth for cinnamon is oftentimes prepared with ombre madder, alum, and argol, and then finished with fustic, redwood and barwood in another liquor.

To dye wool, cinnamon colours.

For one hundred and twenty-five pounds of wool, use

50 pounds of fustic.
60 do. of sanders.
6 do. of madder.

Boil the wares two hours, cool down, have in the wool, boil it two hours, cool down and strew over four and a half pound of ground cream of tartar, and four pounds and a half of alum—boil one hour and let lay all night.

For a crimson of a fuller colour, and more on the red on one hundred and twenty pounds of wool, use

24 pounds of fustic.
42 do. of sanders.

Boil the dye wares and the wool as for the last, then strew over fifteen pounds of alum, boil one hour, and let it lay in all night—wash the wool the morning following, and finish in a clear liquor, with thirty pounds of ombre madder. This is a very rich colour.

The two following receipts are for two lots of very bright cinnamon, done in the same liquor.

For ninety-three pounds of wool, use

45 pounds of barwood.
27 do. of fustic.
5 do. of alum.

Boil the wares two hours, and the wool twenty minutes, land it, and then add to the same liquor for a second lot of wool of eighty pounds,

28 pounds of barwood.
7 do. of fustic.

Boil the wares and wool as before, cool down, and strew over six pounds of alum, boil half an hour, and let lay in all night.

Cinnamon on cotton is dyed by first colouring it yellow, and then red, as given in the receipts for those colours. If the colour should not prove bright enough, work it in soap suds, wring out, dry, and it is finished.

TO DYE FAWN COLOURS.

For sixty pounds of cloth, use

4 pounds of alum.
2 do. of cream of tartar.
4 ounces of logwood.
1 pound of peachwood (nicaragua.)
1 do. of fustic.

Boil the ingredients two hours, and the cloth two, have out and sadden to pattern with copperas.

For a fawn on ninety-two pounds of wool.

1½ pounds of argol.
3 do. of redwood.
1 do. of fustic.
¼ do. of Brazil wood.
¼ do. of logwood.

Boil the ingredients two hours, and the wool two, cool down the liquor, and sadden with one pound of alum and two of copperas—boil half an hour, and if dark enough, land, if not, let it lay in all night.

For a fawn on sixty pounds of wool not quite so red as the last.

1 pound of weld.
¼ do. of ground fustic.
7 do. of umbro madder.
2 do. of best argol, or cream of tartar.
½ do. of tin liquor.
¼ do. of alum.

Boil the ingredients one hour, and the wool one hour; cool down and strew over two ounces of copperas, and one ounce of pearl-ash, boil half an hour, pump up and let lay in all night.

For a fawn for two hundred pounds of wool, still less on the red hue.

6 pounds of weld.
¼ do. of fustic.
6 ounces of logwood.
5 pounds of best madder.
1½ do. of argol.

Boil the ingredients one hour, cool down, have in the wool, and let it be two hours in coming up to a boil, then boil two hours and cool down, strew over three-quarters of a pound of alum, boil a quarter of an hour, cool down again and strew on one pound of cop-

peras and a quarter of a pound of pearl-ash; boil half a hour, cool down, run off the liquor and wash.

To dye silk a fawn colour.

Prepare the same as for drab, stick up three on each stick, strike a lather with hot suds, put into it a little annatto, which will make a buff, wash out in two warm waters and stick up; take a warm liquor, put into it two pails of spent archil liquor, half a ladle of fustic liquor and a ladle of argol liquor, stir well, take a piece of the buff silk and dip in, if not dark enough add a little more of each material. The argol raises the archil, some use vitriol. A ladle holds from four to five quarts.

To dye browns on woollens, such colours as have no blue in their composition, being compounded of red and yellow.

For one piece for brown weighing forty-eight pounds, use

7 pounds of alum.
9 do. of logwood.
2 do. of argol.

Boil the wares two hours, run up with cold water so as to have in quite cool, boil the goods two hours, have them out and cool by throwing, then roll the cloth up and let lay till next day. Prepare a fresh liquor with

7 pounds of alum.
12 do. of barwood.
1 do. of pearl-ash.

Boil the wares two hours, run up, have in the cloth, bring the liquor on to a spring heat, but not to boil out, run at that heat for one hour.

It is usual in English dye-houses to boil a number of cloths in the preparation liquor, and finish them afterwards in the fresh liquor successively.

For a very dark rich brown on one hundred and twenty pounds of wool. For the boiling, use

48 pounds of fustic.
48 do. of sanders.
12 do. of madder.

Boil the wares two hours, run up, have in the wool and boil it two hours, cool down and sadden with one and a half pounds of copperas and two pounds of alum, boil half an hour and let lay in all night.

For a darker and richer brown on one hundred and twenty pounds of wool.

1½ pounds of powdered nut-galls.
30 do. of redwood.
12 do. of sanders.

Boil the wares and wool as before, sadden with one and a half pounds of copperas, boil one hour and let lay all night.

For a lighter brown than either of the above for sixty-eight pounds of wool, use

2¼ pounds of nut-galls.
18 do. of sanders.
4½ do. of peach wood, (nicaragua.)

Boil the ingredients two hours, the wool two, run up and add three-eighths of a pound of copperas, boil a quarter of an hour, cool down again and strew over three pounds of alum, boil one hour and let lay in all night.

For a very dark brown for one hundred and forty pounds of wool, use

70 pounds of chipped fustic.
17½ do. of barwood.
4 do. of logwood.
3 do. of copperas.

Boil the dye wares two hours, the wool two, cool down and sadden with three pounds of copperas and one and a half pounds of alum, boil one hour and let lay in all night.

For a very dark rich brown, for two hundred and sixty pounds of wool, use

224 pounds of barwood.

Boil the dye wares two hours, run up, have in the wool and boil it two hours, cool down and sadden with twelve pounds of copperas, boil one hour and let lay in all night.

For a rich copper brown for one hundred and eighty pounds of wool, use

60 pounds of fustic.
80 do. of barwood.

Boil the dye wares two hours, run up, have in the wool and boil it three hours, cool down and sadden with seven pounds of copperas and three of alum, boil one hour and let lay in all night.

For a very dark rich brown for one hundred and sixty pounds of wool, use

98 pounds of chipped fustic.
58 do. of barwood.
70 do. of peach wood.
4 do. of logwood.

Boil the wares as usual, run up, boil the wool three hours, cool down and sadden with six pounds of copperas, boil one hour and let lay in all night.

For a very rich brown lighter than the preceding, for three hundred pounds of wool, use

100 pounds of chipped fustic.
58 do. of barwood.
34 do. of redwood.
3 do. of logwood.

The wares to boil two hours, run up, enter the wool and boil it three hours, cool down and sadden with four pounds of alum, two of argol, and two pounds six ounces of copperas, boil three hours, and let lay in all night.

For a rich brown yellower than the last, for three hundred pounds wool, use

180 pounds of chipped fustic.
90 do. of welds.
10 do. of common madder.
5 do. of redwood.
2 do. of logwood.

Wares to boil as usual, run up, enter the wool, and boil it three hours—cool down and sadden with nine pounds of alum, ten pounds of redwood, ten pounds of barwood, and three pounds of copperas—boil one hour and a half, and let it lay in all night.

For a rich brown between the two last, for three hundred and fifty pounds of wool, use

350 pounds of chipped fustic.
84 do. of common madder.
3 do. of argol.

Wares to boil as usual, run up, have in the wool, and boil it two hours—cool down and sadden with three pounds of alum, three of copperas, and fifteen of barwood—boil two hours, and let lay in all night. The three last receipts afford remarkably rich browns.

Receipts for olive browns.

For a light olive brown for two hundred and fifty pounds of wool, use

200 pounds of chipped fustic.
70 do. of welds.
8 do. of redwood.
10 do. of mull madder.
2 do. of logwood.

The wares to boil as usual, run up, have in the wool, and boil three hours—cool down and sadden with six pounds of alum, and three

pounds of copperas—boil one hour and a half, and let it lay in all night.

For a darker olive less upon the red, for two hundred and eight pounds of wool, use

140 pounds of chipped fustic.
20 do. of logwood.
8 do. of common madder.
7 do. of best madder.

Wares to boil as usual, run up, heave in the wool, and boil it three hours—cool down and sadden with seven and a half pounds of copperas and seven of alum—let lay in all night.

There are a number of colours having a yellow hue that have no yellow dye in them. They are mostly made on cloth, and very rich and beautiful, being partly made with cochineal, rendered more or less yellow by the action of cream of tartar, and of tin liquor. I shall give receipts for these in this place, because they come nearer to colours made of red and yellow than to any other class.

For a rich wine colour for forty-eight pounds of fine cloth, use for the boiling

5 pounds of alum.
3 do. of cream of tartar.
4 do. of brazil wood.
1 do. of cochineal.
4 pints of tin liquor.

The wares to boil one hour, the liquor cooled down quite low, the cloth to be entered rapidly, and kept in quick motion all the time of working—to be boiled two hours, then prepare a fresh liquor with

6 pounds of brazil.
1½ do. of pearl-ash.
1½ pints of tin liquor.

The wares to boil one hour, cool down and run the cloth till of the colour wanted.

By varying the proportion of brazil, and by increasing or lessening the pearl-ash, a great variety of these colours may be produced.

For a rich wine colour on one hundred and twenty pounds of wool, use for the boiling

20 pounds of alum.
20 do of tartar.
2¼ do. of cochineal.

Boil the alum and tartar half an hour, then the cochineal fifteen minutes, run up, have in the wool, and boil two hours—cool down, land the wool, and bring on a fresh liquor. Put into the fresh liquor half a bushel of bran, when the bran rises, scum it off clean with a fine sieve—then put in forty pounds of best madder, boil two or three minutes, run up, have in the wool, and boil it a quarter of an hour—let it be one hour coming up to a boil—land, and wash.

For a fine wine colour on one hundred and twenty pounds of wool, use for the boiling

1 pound of cochineal.
7½ do. of brazil.
25 do. of alum.

Boil the wares two hours, run up, enter the wool and boil it three hours—then strew over six gallons of urine, work the wool well, and let lay all night. Wash the wool, and finish in a fresh liquor, with seventy pounds of best madder.

To dye chocolate on cotton.

The cotton to be boiled in a liquor of nut-galls, and alumed the same as for red. Then use six ounces of alum and two of copperas to each pound of cotton, wring out and dry as for red—prepare it a second time in alum and copperas, wring out and dry again—wash well and wring—then madder it with half pound of madder to each pound of cotton, the same as for red, wash well, and it is finished.

If not red enough, give it a small quantity of brazilletto chips, if not enough on the claret, give it a very little logwood.

Common mode of dying chocolate on cotton.

Prepare the cotton with sumac instead of galls, sadden with two ounces of copperas to one pound of cotton, wash well, and return it in the sumac liquor—wash well, wring out, and return it again in the copperas liquor—wash well, dry, and alum it with six ounces of alum to each pound of cotton—then proceed as directed for the last chocolate.

Third receipt for chocolate on cotton.

Give to the cotton the usual preparation—for each pound boil four ounces of sumac, turn in the cotton, squeeze out, and turn in again, putting it in as open and as even as you can, and let it lay all night. In the morning wring out gently, and dissolve for each pound of cotton one ounce of copperas, turn in with the water sufficiently warm, and work half an hour—wring out, wash well, and add some urine to the sumac liquor, turn in the cotton, and work quick for fifteen or twenty minutes—squeeze out, dissolve one ounce of copperas to each pound of cotton, and add it to the former liquor—turn in and handle well for twenty minutes, wring out and wash well. If a brown chocolate is wanted, and the sumac liquor

should not be turned, put some urine to water, and while that is doing, boil for each pound of cotton half a pound of brazilletto chips, (if not for a very red colour, four ounces will do,) pour in a little urine, or lime water, while the liquor is boiling—when boiled, take off the clear liquor, and turn it in at the usual heat—when it has been well worked in this liquor, dissolve for each pound of cotton, one ounce of alum in warm water, stir well, and turn in the cotton—let it lay one hour, wring out, and turn it into the brazilletto liquor as before—wring out, dry, and it is finished.

If wanted of a blue cast, or more like purple or claret, the urine must be omitted, and after it has been alumed the second time, add logwood liquor to the brazilletto, by which, different shades of colour may be produced.

To dye brown on cotton.

Give a ground of sumac, handle well, and let it lay in the liquor all night. In the morning add, for each pound of cotton, two ounces of copperas, when well worked, wring out, and wash well—turn into the sumac liquor again for fifteen minutes, then copperas a second time without washing. Make a lime-water with a handful of lime for each pound of cotton, put the lime into a bucket of water, stir well, let stand till clear, pour off the clear liquor, add more water to the lime, and repeat till liquor enough is obtained to work the cotton—turn in and work very quick. While this is doing, take scalding water, and put into it for every pound of cotton, one pound of ground black oak bark—put the bark into a tub, and pour the boiling water on it, and sprinkle into it for each pound of cotton half an ounce of lime—turn in the cotton, at the usual heat, for fifteen or twenty minutes, wring out, dry it, and it will be a fine brown.

The darker the colour is before turning into the lime-water, the finer and richer it will be when finished.

To dye morone on silk.

Wash the silk from boiling in soap, alum as usual for three hours, wash in two tubs of cold water and stick up; take four or five pail fulls of brazil liquor, pour on it water as hot as the hand can bear, turn in the silk and handle till of the colour wanted, wring out and dry in a stove.

To dye colours compounded of red and blue.

In this class of colours are comprised imperial blues, purples, lilacs, crimson, pink, mulberry, claret, corbeau, &c.

To colour imperial blue, nothing more is necessary than to boil more or less of archil and alum, and run light blues through the liquor at a boiling heat till of the colour wanted. When the imperial is required to be very red, use cutbear, either by itself or with the archil.

To colour ninety pounds of fine cloth a rich purple, prepare the liquor by putting into it a quarter of a peck of bran, and when it rises to the surface, as it begins to boil, scum the bran off, clean with a fine sieve. Use for the boiling

4 pounds of cream of tartar.
6 do. of alum.
4 pints of tin liquor.
1½ pounds of cochineal.

Boil the alum, tartar and tin for one hour, then the cochineal for ten minutes, run up, heave in the goods and boil two hours. Prepare a fresh liquor with

4 pounds of alum.
6 do. of brazil wood.
4 pints of tin liquor.
18 pounds of logwood.
3½ pounds of chemick.

Boil the wares two hours, run up, heave in cool and work rapid. Boil till finished.

For a very light purple, on one hundred and twenty pounds of wool, for the boiling, use

21 pounds of alum.

The wool to boil in this liquor for two hours, then land and add twenty-four pounds of cream of tartar, and four pounds of cochineal; boil the tartar one hour, then add the cochineal and boil a quarter of an hour; cool down, heave in the wool rapidly and boil to the colour wanted. By blueing in the woad vat any body of purple may be obtained, but this should be done, and the wool well washed before dying in the furnace.

For a purple for one hundred and twenty pounds of wool. Make it first a very light blue in the woad vat, wash very clean, and boil it with sixteen pounds of alum, land the wool, and add to the liquor twelve pounds of cream of tartar and three pounds of cochineal. Boil the wool till of the colour wanted.

When darker purples are required, they may be finished in a fresh liquor with brazil wood and logwood.

TO DYE PURPLE ON COTTON.

COTTON for purple must be well cleansed and should be bleached. Take for each pound one quart of iron liquor, and four quarts of water; put this into a brass or copper kettle, add for each pound of cotton half an ounce of salt-petre, half an ounce of sal-armoniac, and half an ounce of cream of tartar, all pounded together till fine, and kept over the fire till scalding hot; take it off the fire, and when cooled sufficiently to bear the hand in it, turn in the cotton, squeeze out, turn in again and let lay all night: wring out in the morning, dry and wash. It must now be galled, the same as for

red, allowing half a pound of gall for each pound of cotton; wring out, dry, and it is finished.

This colour may be raised with logwood liquor, but it will not stand.

To colour a common purple on cotton.

Boil and well wash the cotton, for each pound, boil half a pound of logwood, take the clean liquor, and when you can bear the hand in it, add urine, turn in the cotton for an hour, then raise it out, and put it on a pin to drain. Make a fresh liquor by dissolving for each pound of cotton three-quarters of an ounce of alum in as much water as will be sufficient to work the cotton in, add a dish of logwood liquor, squeeze the cotton and turn in, handle as quick as possible for two or three times, it must be worked till it becomes of a beautiful lilac. When the colour is as bright as you wish, wring out gently, wash it a little, wring it even and turn it into the logwood liquor again, and work it quick once or twice. If the liquor does not work well, add for each pound of cotton, half an ounce of alum, when dissolved stir well, turn in for fifteen or twenty minutes, wring out evenly and dry in the shade.

To colour lilac.

To dye lilac on one hundred and twenty pounds of wool. For boiling, use

12 pounds of alum.
9 do. of cream of tartar.

The ingredients to boil one hour, the liquor run up, and the wool to boil two hours; land it, and boil one and a quarter pound of cochineal for a quarter of an hour, cool down, heave in the wool rapidly and boil to the colour wanted.

Any shade may be obtained by slightly blueing it in the woad vat previous to dying it in the furnace, and by varying the quantiy of cochineal.

To colour lilac on silk.

Boil it after pink, then take a thin liquor of lather, put into this some red archil liquor, and well work the silk in it; then wet out in a lather made with soap lees and lime water, in which it may be blued to the colour wanted.

To dye crimson.

For crimson on forty-eight pounds of fine cloth—use for boiling,

3 pounds of alum.
2 do. of cream of tartar.
½ do. of cochineal.
3 pints of tin liquor.

Boil the ingredients one hour, cool down, have in the cloth, and boil two hours. Prepare a fresh liquor and put in

2 pounds of alum.
3 do. of pearl-ash.
4 do. of brazil wood.
2 do. of urine.

Boil the wares one hour, then add the urine; cool down, have in rapidly, and boil to the colour wanted. It is often finished without boiling the cloth, by keeping the liquor at a spring heat.

For a crimson on sixty pounds of wool, use for boiling,

1 pound of cochineal.
3 do. of crop madder.
6 do. of argol.
3 do. of alum.
4 pints of tin liquor.

Boil the alum, argol, and tin liquor, for half an hour, then add the madder and cochineal, and boil ten minutes, run up, have in the wool, and boil it two hours—run off the liquor and wash clean. Prepare a fresh liquor with

6 pounds of cutbear.
2 buckets of urine.

Boil the cutbear half an hour, and then put in the sig—soon as

this is done, run up the furnace, have in cool, let it be two hours coming up to a spring heat, and it is finished.

To dye a pink.

To colour fifty pounds of cloth a fine pink, use

4 pounds of alum.

Boil the cloth one hour, have out, and add to the liquor

4 pounds of cream of tartar.
4 pints of tin liquor.
1 pound of cochineal.

Boil the cloth until the colour is rich and bright. If wanted to be bluer, add urine to the liquor till enough.

For a pink on one hundred and twenty pounds of wool, use for boiling,

2 pounds of cochineal.
18 do. of alum.
12 do. of cream of tartar.

Boil the alum and tartar for half an hour, then the cochineal for a quarter of an hour, cool down, have in the wool, and boil two hours—let lay all night.

Pinks may be made into rich wine colours by boiling them in a strong madder liquor, or into lilac, by bluing them in a very weak vat before dying pink. If done in too strong a vat it will make a purple.

To dye pink on silk.

Take of safflower, one hundred and twelve pounds, wash it well in a tub of water, having a reel placed inside of it, until all the yellow comes out—when well washed, fill up with clean water, and add four pounds of pearl-ash, draw this off, fill again with water, and let this lay till the flower is quite white. The two last liquors are used for dying the pink, add to it two or three pails of lime-juice, which will neutralize the ash, and produce a beautiful rose.

Take large hanks of silk, and let them lay in the liquor till all the liquor is extracted—then throw the liquor off, and pump up with fresh water, add to it one pail of lime-juice, and let the hanks lay in this liquor till wanted. Wring out the hanks when wanted, put them in water of a milk heat, with a small quantity of pearl-ash, when the silk has spent its colour, add a little lime or lemon-juice, to bring to the colour wanted.

If any of the silk should not be dark enough, re-dye until like the darkest. After the pink is dark enough, wring it out in handfuls, then make a small tub of water with lime-juice, give a few turns in this, wring out, and dry. The last process is called scrooping.

To dye mulberry.

For forty-eight pounds of cloth, for a rich mulberry, for the boiling, use

3 pounds of alum.
2 do. of cream of tartar.
3 pints of tin liquor.
1 pound of argol.
1 do. of cochineal.

Boil the ingredients for half an hour, cool down, have in the cloth rapidly, and boil two hours. Finish in a fresh liquor, with

3 pounds of alum.
16 do. of brazil wood.
14 do. of logwood.
1 pint of tin liquor.
1 pound of best crop madder.

Boil the wares two hours, cool down, enter the cloth rapidly, and boil to the colour wanted.

For a dark mulberry on two hundred pounds of wool.

100 pounds of barwood.
30 do. of logwood.
3 do. of cream of tartar.

Boil the wares two hours, cool down, have in the wool, and boil it three hours—cool down, and sadden with three pounds of copperas—let it lie in all night.

To colour mulberry on silk.

Boil with coloured soap, and wash out—alum and wash out—take of brazil liquor three or four pails, put it into a back, and throw on it nine or ten pails of boiling water, pump up, stir well, and put in half a ladle of logwood liquor—turn the silk in this seven or eight times, then take it out and lay it by the furnace—add more logwood and brazil till of the desired colour—when nearly dark enough, throw a pail of urine into a back of clean water, milk warm, turn in, and make rather bluer than pattern. If the urine does not make it blue enough, take a clean liquor, and blue with pot-ash.

Plum colours on silk are dyed the same as mulberry, with less brazil.

To dye claret.

For a claret on forty-eight pounds of cloth, use for boiling

5 pounds of alum.
1 do. of argol.
5 do. of brazil.
5 do. of logwood.
1 do. of madder.

Boil the wares two hours, run up, have in the cloth, and boil one hour and a half—then finish in a fresh liquor with

6 pounds of brazil.
1½ do of pearl-ash.

Boil the wares half an hour, run up, have in, cool and bring on gradually—boil till of the colour wanted.

For a dark claret on one hundred and seventy pounds of wool.

210 pounds of barwood.
4½ do. of cream of tartar.

Boil the wares two hours, run up, have in the wool, and boil gently for three hours—cool down and sadden with three pounds of copperas. Let it lie in all night.

For a light claret for one hundred and seventy pounds of wool, use for boiling

168 pounds of barwood.
10 do of cream of tartar.

Boil the wares two hours, cool down, have in the wool, and boil three hours—cool down and sadden with two pounds of copperas. Let it lie in all night.

To colour morone on silk.

Wash from boiling in soap—alum for three hours, wash in two tubs of cold water, stick up, take four or five pails of brazil liquor, pour on water as hot as the hand can bear, put in the silk and handle—when of the colour wanted, wring out and dry in stove.

To dye corbeau.

For a very dark corbeau on one hundred and sixty pounds of wool. For the boiling, use

112 pounds of barwood.
28 do. of logwood.

The dye wares to boil three hours, the furnace run up, the wool entered and boiled two hours, sadden with ten pounds of copperas, and six of fustick—boil one hour and a half, and let lie in all night.

For a lighter corbeau on two hundred and forty pounds of wool, use for the boiling

112 pounds of redwood.
30 do. of logwood.

The wares to boil three hours, run up, and have in the wool and boil it three hours—cool down and sadden with three pounds of copperas—boil one hour and let lie in all night.

There are many colours of a more complexed kind than any I have given receipts for, being compounded of yellow, red and blue, and some mostly yellow: such are tea browns, London smoke and Paris mud. I shall give receipts for those in this place, as the browns will then be complete.

Tea browns approach nearly to a dark olive, with less of green than an olive green, and less of red than an olive brown.

For a tea brown on fifteen pounds of cloth.

3 pounds of alum.
2 do. of argol.
6 do. of madder.
4 do. of fustic.

Boil the wares one hour, run up, have in the cloth, and boil one hour and a half—cool down, take out the cloth and add to the liquor four pounds of logwood and half a pound of copperas—boil the wares half an hour, run up, have in the cloth and boil to the colour wanted.

For a tea brown on sixty pounds of wool. For the boiling, use

18 pounds of fustic.
6 do. of barwood.
5½ do. of logwood.
4 do. of common madder.
½ do. of argol.

Boil the wares two hours, cool down, have in the wool and boil it two hours—cool down and sadden with three-quarters of a pound of copperas. Boil one hour, and let it lie in all night.

For a London smoke on two hundred pounds of wool. For the boiling, use

8 pounds of rasped fustic.
6 pounds of redwood.
6 do. of logwood.
5 do. of ombre madder.
2 do. of camwood.
20 do. of barwood.

The wares to boil two hours, run up, have in the wool and boil one hour and a half—cool down and sadden with two pounds of copperas and nine pounds of argol—boil one hour, and let lie in all night.

For a Paris mud for two hundred and sixty pounds of wool. Boil the wool with fifty pounds of alum for three hours; land and well wash; finish in a fresh liquor with

80 pounds of chipped fustic.
3 do. of logwood.

Boil the wares two hours, run up, have in the wool and boil three hours, then throw on twenty pounds of rasped logwood and boil three hours, cool down and throw on four pounds of rasped logwood, boil one hour and let lie all night.

TO DYE DRABS.

IN drabs there are a great variety of colours, and an immense number of shades; some have a blue hue, some a red, some a yellow, and there are many that do not partake of either of these hues. I shall begin with drabs that have a blue hue, and proceed with others in the order mentioned.

For a very light blue drab, on forty-five pounds of cloth,

2 pounds of alum.

1½ pounds of argol, or cream of tartar.
2 do. of chipped logwood.

Boil the wares one hour, cool down, have in the cloth and boil two hours; cool down, take out the cloth, bring the furnace to a boil, and while boiling drop in two ounces of chemick, boil ten minutes, cool down, have in the cloth very rapidly, and turn the reel as fast as the cloth can be opened after it is entered—bring the liquor to a boil, and run till the desired colour is obtained. Cloth may be dyed to any shade, by using more or less of chemick and logwood.

For a blue drab on one hundred and twenty pounds of wool.

5 pounds of weld.
4 do. of common madder.
2 do. of logwood.
1½ do. of argol.

Boil the wares one hour, cool down, have in the wool and boil one hour—then add half a pound of alum, three-quarters of a pound of copperas, and half a tea cup full of chemick—boil three-quarters of an hour, and let lay all night—a little archil will give a blue blush to these colours.

I must inform those who are not well versed with working wool in the furnace, that whenever chemick is added in the saddening, it must be first mixed in a bucket of the liquor, and then strew over the wool a small quantity at a time, while the wool is being rapidly worked. Those who are quite ignorant of the process, had better land the wool and mix the chemick in the liquor by stirring it well with the dye-house rake previous to re-entering the wool.

For a very dark blue drab on one hundred and twenty pounds of wool.

12 pounds of weld.
2 do. of fustic.
8½ do. of logwood.
2 do. of argol.

1 tea cup full of chemick.

Boil the four first articles one hour, then drop in the chemick while the furnace is boiling; boil ten minutes after it is in, cool down, enter the wool and boil it one hour; then add one and a half pound of alum, and boil a quarter of an hour; then one and a half pounds of copperas and one tea cup full of chemick, boil one hour and let lay in all night.

To dye red drabs.

For a very light drab having a red hue, on one hundred and twenty pounds of cloth,

2 pounds of alum.
2 do. of argol.
1½ do. of best madder.
2 pints of tin liquor.
20 pounds of fustic.

Boil the wares two hours, cool down, enter the cloth and boil one hour and a half, or till of the colour wanted. Any shade may be obtained by adding more or less of madder and fustic, as well as of tin liquor.

A strong decoction of alder bark makes a red drab without any mordant; blue vitriol darkens it without injuring the red, and copperas turns it of a greenish drab.

For a light red drab, on one hundred and twenty pounds of wool.

1 pound of nut-galls.
4 do. of madder.

Boil the wares half an hour, run up, have in the wool, and boil half an hour, cool down and strew over one pound of copperas and half a pound of alum; boil half an hour, while boiling, strew over one and a half pounds of fustic, and one and a half pounds of cream of tartar, boil half an hour, and if dark enough, cool down and land, if not, let it lay in all night.

For a dark red drab, on one hundred and twenty pounds of wool,

2 pounds of ground sumac.
7½ do. of fustic.
2¼ do. of barwood.
1 do. of sanders.
3 do. of umbro madder.

Boil the wares two hours, run up, have in the wool and boil two hours, cool down and sadden with one and a half pounds of copperas, and one and a half pounds of alum, boil one hour and land.

To dye yellow drabs.

As these are the colours most generally worn, I shall give more receipts than for the others, including a greater variety of shades.

For a very light drab, having a slight yellow tinge, on eighty pounds of wool.

1½ pounds of ground fustic.
½ do. of logwood.
¼ do. of best madder.

The wares to boil two hours in a coarse bag, the furnace run up, and the wool boiled two hours—cool the liquor by running up with cold water—then strew over, for saddening, one pound of alum, and four ounces of copperas, having previously dissolved them in a bucket of the liquor—let the wool boil one hour—run off the liquor slowly, and while this is doing, run up with water sufficient to cool the liquor so low as to make it pleasant to immerse the hand—when the liquor is all run off, land the wool and well wash.

For a drab a few shades darker than the above, on forty-two pounds of wool.

1½ pounds of fustic.
¾ do. of logwood.
¼ pound of madder.
½ do. of alum.

To be proceeded with as for the last, and add for the saddening, half a pound of copperas—let boil half an hour, land and wash, as before.

For a darker colour, varying a little in the shade, on seventy-four pounds of wool.

2 pounds of fustic.
1 do. of logwood.
½ do. of madder.

To be proceeded with as for the two last, sadden with one pound of alum, and three quarters of a pound of copperas—boil half an hour, and let it lay all night.

For a light yellow drab, on three hundred pounds of wool.

38 pounds of weld.
8 do. of logwood.
4 do. of argol.
4 do. of alum.
1½ do. of copperas.

Boil the weld in bags one hour, take it out, add the other ingredients, boil half an hour, run up, have in the wool, and boil it two hours—then run up, and add one pound eight ounces of oil of vitriol, work well for ten or fifteen minutes without boiling—if the colour is dark enough, cool down, run the liquor off, and wash—if required to be darker, let it lie in all night,

For a light drab, not so yellow as the last, on two hundred and seventy pounds of wool.

15 pounds of weld.
2 do. of fustic.
7 do. of logwood.
2 do. of umbro madder.

3 pounds of argol, or cream of tartar.
2 do. of alum.

The weld to be boiled in bags and taken out as the last, the other wares to boil one hour, the furnace run up, the wool entered and boiled one hour—cool down and add six ounces of copperas and a quarter of a pint of oil of vitriol—boil half an hour, run off, or let lie according to the colour wanted.

For a dark yellow drab on two hundred and forty pounds of wool.

20 pounds of weld.
1½ do. of red argol.
1 do. of rasped fustic.

The wares to boil as before, have in the wool and boil one hour—then add by strewing over

3½ pounds of ground logwood.
3½ do. of ombre madder.

The wool to boil two hours, cooled down and landed—add to the liquor

1 pound six ounces of copperas.
1 do. of alum.

Stir well, have in the wool, boil one hour—let it lie in all night.

For a dark yellow drab, on two hundred and forty pounds of wool,

20 pounds of weld.
5 do. of rasped fustic.
4 do. of logwood.
12 do. of common madder.
2 do. of copperas.

The weld to be boiled one hour and taken out, after which add the other materials. boil one hour, run up, heave in the wool and boil two hours, land, or let it lie all night.

There are many drabs that do not come under the denomination of blue, red, and yellow, such are pearl drabs, green drabs, &c. I shall proceed to give receipts for these, for although there are not

now fashionable, excepting the pearls, they may become so as the fashion changes.

To dye pearl drabs.

For a very light white pearl on one hundred and twenty pounds of wool.

1 pound of alum.
6 ounces of logwood.

Let the wares boil half an hour, run up, heave in the wool and bring the liquor to a spring heat, keep at this heat for a quarter of an hour, land and wash. The wool must be briskly handled all the time it is in the furnace.

For a light red pearl on one hundred and twenty pounds of wool.

14 ounces of argol.
8 do. of logwood.
6 do. of brazil.
4 do. of redwood
4 do. of alum
4 do. of copperas.

The wares are to be boiled half an hour, the furnace run up, the wool entered and boiled a quarter of an hour, cool down, landed and washed.

For a pearl on sixty pounds of wool.

½ pound of nut-galls.
¼ do. of madder.

The wares are to be boiled half an hour, the furnace run up, the wool entered and boiled a quarter of an hour; while boiling, add two ounces of alum, cool down and land.

TO DYE GREEN DRABS.

FOR a light greenish drab, having an olive hue, on one hundred and sixteen pounds of wool.

15 pounds of weld.
2 do. of logwood.
1 do. of fustic.

The welds to be boiled one hour and taken out; then the other wares one hour, the furnace run up, the wool entered and boiled one hour, then cool down and sadden with six ounces of copperas and three pounds of alum, boil one hour and land.

For a dark green drab on fifty-eight pounds of wool.

5 pounds of fustic.
2 do. of logwood.
½ do. of madder.

Boil the wares two hours, run up, enter the wool and boil it two hours, cool down and sadden with

¾ of a pound of alum.
¼ of a pound of pot-ash.
2 ounces of copperas.

Boil half an hour, and then add a quarter of a pint of oil of vitriol; let it lie in all night.

For a very dark muddy brown drab, which has been lately very fashionable, when mixed with white or light blue.

8 pounds of rasped fustic.
6 do. of redwood.
4 do. of logwood.
4 do. of ombre madder.
1 do. of camwood.
8 do. of barwood.

The wares to be boiled two hours, the furnace run up, the wool entered and boiled one hour and a half, then cool down and sadden with two pounds of copperas and nine pounds of argol.

To dye drab on cotton.

Mix fustic and sumac liquor in warm water, turn in the cotton and work it well; if for a brownish drab, turn the cotton into a weak copperas liquor; if for a greenish drab mix logwood with the fustic and sumac, and a little blue vitriol with alum and copperas; when well worked, wring out lightly and it is finished.

To dye drab on silk.

Boil it in black soap, wash out, and stick up as for other colours —put a little spent urchil into a very warm liquor, a little fustic, a little logwood, and strew in a little copperas—stir up well, and try a pattern—when too blue, use a little argol, or cream of tartar, which will raise the red of the logwood.

On dying of double colours.

Cloth is sometimes dyed double colours. that is, one side of a cloth is dyed of one colour, and the other side of another. Such colours are rarely seen in this country, and are only seen occasionally in Europe; but as they were once fashionable, and may become so again, I shall finish the subject of dying by giving the processes for dying these. The principle markets at the present time for double colours are Turkey and Arabia. The Arabs cover their horses with cloth dyed purple and scarlet, by turning up the corners they show a beautiful drapery, and the corners being hung with gold or silver tassels, give to the horses furniture a very rich and elegant appearance.

There are two kind of double colours, those having green on one side and yellow on the other, and those having purple on one side and scarlet on the other. We will commence with the first.

Cloth made for double colours, should be fine in quality, wove very stout, eleven quarters in the loom, not more than twenty-four yards when fulled, and left under six quarters wide. They should have a good nap raised on both sides, and finished shearing before they are dyed. They must be well pized with fuller's earth, and dried to prepare them for the dye. When for yellow and green, the cloth must first be dyed a bright yellow as follows—for forty-eight pounds of cloth, use in the boiling

10 pounds of alum.
2 do. of cream of tartar.
25 do. of fustic chips.

Boil the wares two hours, heave in the cloth and boil it four hours—then cool down, heave out, stream it till clean and dry. A flour paste has now to be prepared. We have in England two sorts of wheat, one of which affords a flour that will make a tougher paste than the other; when flour is ordered for double colours, it is always such as will produce the toughest paste. The paste is made the day before it has to be used. It requires a stiff paste to prevent its penetrating through the cloth when rubbed on, yet thin enough to work thoroughly into the nap of the cloth. When this has been properly prepared, one end of the cloth is placed on a smooth table about five feet wide and twelve long, beginning at one end, the side intended to be pasted, lying uppermost. One person lifts the paste out of the tub with a clean tin or copper ladle, and places it on the cloth, while two others are employed in rubbing it into and all over the face of the cloth with their hands. Soon as a piece has been pasted, the two ends are brought together, and the whole piece doubled, leaving that side which has been pasted, inside. The cloth is now placed upon a long scrave or table, and four or more women are employed to sew the lists together, these are turned in and rolled before sewing, the work is drawn tight and the stitches are close together to prevent any liquor from penetrating through the lists. The two ends are rolled and sewed up in the same way. Care must be taken, during this operation, that none of the paste touch the side of the cloth that has not been pasted, for, in such places, the cloth will not receive

the destined colour. While this has been doing, the furnace must be brought on with a new liquor, into which put

4 pounds of alum.
4 do. of fustic.
3 do. of chemick.

Boil the alum and fustic two hours, drop in the chemick, and boil ten minutes. Let the cloth, which is now very heavy, be brought to the furnace on a clean hand-barrow and placed on the curb—open a few stitches in the end sufficient to make such an opening as will admit the nosel of of a bellows, and blow in as much air as can be forced into it. Let the opening be immediately sewed up. Two men must now carefully lift the cloth off the hand-barrow into the furnace keeping the folds square and even, while two others are employed in placing it under the liquor with stopping sticks. Care must be taken not to hand it in faster than the stoppers can put it under the liquor, yet it is necessary this operation should be performed as rapidly as possible. The air blown in by the bellows, will be confined in the inside by the paste ; and when the cloth comes in contact with the hot liquor, the air becomes so expanded as to swell as large as a butt, and this moving, as the cloth is worked, prevents the paste from sticking together, and enables the workmen to move it in any direction. It has now to be worked backwards and forwards, first on one side of the furnace, and then on the other, at every three or four turns the end is tumbled over so as to bring the side that was lowest in the furnace to be uppermost. The working must be done expeditiously to make the colour even, it should be had in cool, and the liquor brought on to a boil very gradually. When boiled to the colour wanted, the liquor is cooled down so far as to enable the workmen to handle the cloth which has now to be lifted out by hand into a large back of cold water. Before opening the cloth, it must be streamed till no stain appear on the water ; when washed clean, the twine is taken from the lists, the paste scraped off as clean as possible, and then cleaned in the stocks till all the paste is completely washed off. It is then tentered, dried, pressed, and packed. The

side that was pasted, will now be of a beautiful yellow, and the other of a rich green.

It requires some experience to perform this operation with perfect safety, and the cloth must be free from holes or thin places.

To dye a double colour, having purple on the one side, and scarlet on the other.

The cloth has to be pized and dried, the same as before. It is now pasted when white, and sewed up, as directed for the yellow in the last. When this has been done, take it on a hand-barrow to the blue vat, blow in air, sew the hole up, take it into the vat, and work till it becomes of a light blue. It is then taken out of the vat, the paste scraped off, and streamed. Care must be taken while this is doing, that none of the blue touches the side that has been pasted. When streamed, take it to the fulling-mill, and wash it under the hammer thoroughly. It must now be hung up to drain until the next day. When drained, clean it in the fulling-mill with earth, and dry it. The side that was pasted will now be white, and the other a light blue—the side that is blue must be placed inside, bringing the ends of the cloth together, and sewed up with rolled lists, as before, ends as well as sides. When this is done, take it to the scarlet furnace, and colour the white side scarlet, after the same way, with respect to workmanship, as directed for green. There having been no paste put on this time, the liquor will have penetrated sufficiently through the cloth, to make the side that was blue of a rich purple. The cloth has now to be well cleansed, by streaming after the ends and lists have been opened, and finished the same as the green.

This appears, on paper, to be a very simple operation, but is not found so in practice. The cloth must be very stout made, and very fine in the ground, to prevent the paste from working through it, and it becomes so heavy, when pasted, as to require four men to carry it on a hand-barrow, which renders it very difficult to

work, and makes it very liable to be torn during the operation, which ruins the work.

The price paid to the dyer, for scarlet and purple, was, twenty years since, two dollars and one-third per yard.

ON BLEACHING OF COTTON, BY CHEMICAL PROCESS.

The materials used for this purpose, are fine salt, sulphuric acid, and manganese. The sulphuric acid decomposes the salt, combining with its soda, and liberating its muriatic acid, which in its turn decomposes the oxyde of manganese, and enters into combination with its oxygen, thus forming what Davy calls chlorine, and was known before the nomenclature was altered by him, by the name of oxy-muriatic acid gas. "It is of a yellowish green colour. Its odour is intolerably acrid and suffocating. It cannot be breathed without proving fatal. When atmospheric air, containing a mixture of it is breathed, it occasions a violent and convulsive cough, attended with much pain in the chest."

I thought it necessary to premise thus much, in order to guard those who may undertake the process, against its destructive effects.

The form of the retort in which this gas is made, must be given in order to make my instructions intelligible.

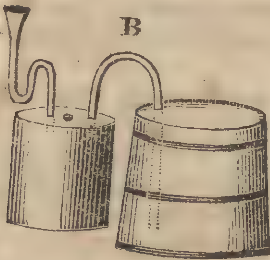

Figure A, is a safety tube used to prevent any accident during the operation, and is also used to convey the sulphuric acid into the retort, after the other materials are put in, and the whole well luted down. B, is a distilling tube, through which the gas passes over into the receiver.

It is important to observe whether the sulphuric acid is of the standard, specific gravity, 1. 85, that is, whether it weighs eighty-five per cent. more than the same measure of distilled water, since a small deficiency, in this respect, will be attended with a great deficiency of strength. In "Thompson's Chemistry" there is a table showing the strength, and consequently, the value of sulphuric acid, of different specific gravities. It will there be seen, that when sulphuric acid is of the specific gravity, 1. 85, it will contain fifteen per cent. of water, when of 1. 80, it will contain twenty per cent., and so on. As all good oil of vitriol ought to be at least 1. 85, it will be found a great loss to the bleacher, when it proves to be below that standard.

Still more important is the purity of the manganese; for if it contains much calcarious, or other earthy matter, there is not only a loss of so much manganese, but a greater loss of sulphuric acid, necessarily wasted in saturating the earthy matter. There are two

distinct ores of manganese, the grey and the black—the grey is the richest ore, but is very subject to be combined with lime, some samples containing eight per cent.; therefore, the black is to be preferred, as it is said to contain no lime, its impurity consisting principally in sulphur, which has no injurious effect in this process.

Fine salt should be employed for this purpose, that which is called blown being the best. It should be clean, and free from all adulterations.

The next object is, to obtain a caustic alkali, for the carbonic acid contained in the alkali that is offered for sale, renders it much less efficacious than when it is made caustic by lime. For this purpose add to the alkali half its weight of quick lime, and boil them for half an hour in water. When clear, the solution is poured off, and more water added, to wash the sediment, and this process is repeated several times, till the alkali is found to be all extracted. When the alkali is to be used in the receiver, it is unnecessary to separate all the lime—and if the receiver be filled with lime-water, the boiling in lime may be omitted.

To prepare the bleaching liquor.

To a receiver containing one hundred and twenty gallons of water, add eight pounds of pearl-ash, rendered caustic by lime. For this quantity put into the retort fourteen pounds of manganese, and from sixteen to twenty pounds of salt, mixed with three gallons of water. The cover and tubes are then firmly luted by driving into the joinings a stiff putty, and afterwards, dry powdered chalk. The cover also should be fastened down to ensure safety.

When things are thus disposed, sixteen pounds of sulphuric acid are poured through the crooked funnel; but slowly and at intervals, that the gas may not pass too rapidly, which is known by the violence of the ebullition in the receiver, and the escape of the noxious fumes. This is a tedious process, and usually consumes

half a day. It would be easy to place a vessel of the acid so that a very small stream might constantly pass into the funnel, and thus the operation be suffered to go on of itself. There would be a saving of time, and the supply of acid would be more uniform, occasioning a less waste of the gas. After all the action has ceased, which may be known by applying the ear to the receiver, or by grasping with the hand the tube leading to it, a fire is kindled under the retort. This must also be regulated by the evolution of gas, and continued till no more passes over, which usually occupies three or four hours. By this time the gas tube will be hot, owing to the passage of steam, though during most of the process it will be cold.

The bent funnel is not always so adjusted as to operate as a tube of safety, in which case it will be necessary to open the retort as soon as the heat decays, otherwise the bleaching liquor from the receiver will pass into the retort and fill it. In every case it may be proper to open it and pour in cold water, for a large mass of heated brick work and sand will cause the contents to boil for a long time after the fire is removed, and thereby to become indurated. For the greater safety of the retort, it is thought by some useful to keep the sand in which it is embedded filled with water.

It is necessary to be attentive to these and such like minutiæ, which have been the occasion of many failures to young practitioners.

BLEACHNG.

THE first process which the cloth usually undergoes, is fermentation, which is very usefully attended to when time will admit, though it is not indispensable. When this has been well performed, a quantity of gelatinous substance has collected in the water, and in the subsequent washing much foam, like that of soap suds,

has been produced. I have sometimes fermented in weak lye, in which cloth has been boiled. In either case it is, of course, preferable in a warm state. When put into the fermenting liquor, it is loosely folded, and the two corners of the end tied round it. In this state it is also boiled and washed. The washing is repeated after every other process, severally, till it is finally dried, and is performed at least six times.

After fermenting and washing, it is next boiled in lye. Bleachers use different proportions of pot-ash, but three pounds to the hundred weight of cloth is considered by good bleachers as sufficient. The same liquor will answer several times, and perhaps any number of times, by adding additional pot-ash, and a sufficient quantity of water to supply the loss. The process of bucking, with suitable apparatus, would be preferable to boiling. I have known this tried by hand, but it was found much too laborious. The lye will become deeply coloured and thickened, and it is said will, sometimes, acquire the consistence of molasses, by dissolving and combining with the colouring matter of the cloth.

When the cloth is put to bleaching, it must be untied and loosely thrown into the liquor, crowding it down but little. One-third part of the contents of the receiver, as before described, diluted with three or four times the quantity of water, will be sufficient for one hundred and fifty pounds of cloth. The time it remains in the bleaching liquor, must be determined by convenience, but twelve hours is sufficient, perhaps much less. Those who use the hyperoxy muriate of lime, say it is slower in its operation.

Lime would be more economical than pot-ash, and is said to answer as well. I made one experiment, however, with it, but from some cause, was not very successful, much of the gas escaping. When lime is used in the receiver, in place of pearl-ash, continual agitation is requisite to keep it suspended in the liquor, and perhaps even then it does not combine so readily with the gas as pot-ash, the one being mechanically, the other chemically divided.

It is the same with carbonate of magnesia, recommended by Davy, yet this substance I employed in my first bleaching experiment with complete success.

To return from this digression, the boiling and bleaching, with the washings, must be again repeated, which will generally be sufficient. Less alkali will be required after the first boiling, and a fresh solution of pearl-ash is preferable, as it keeps the cloth nicer than common pot-ash. After the cloth is sufficiently bleached, it is put into a souring in order to take out such stains as it may have contracted, as also, to prevent its acquiring a brown tinge by time. It is usually recommended to make the water as sour to the taste with oil of vitriol as lemon juice. The cloth looks the clearer for being in a pretty strong acid, in which it should remain twelve hours. When it comes out of this liquor, clear water should be made to pass through it three or four times, filling the vessel and drawing off at the bottom. This will take out much of the acid, after which it must be carefully and thoroughly cleansed, by repeated washings.

It is said the cloth will have a brighter appearance for being dried in the shade.

The process for yarn or thread, is essentially the same as that described for cloth; but it seems to require a greater strength of bleaching liquor, or that the process should be oftener repeated. The labour of washing is much greater. Some persons pass a large stream of water through it for some time, which will cleanse it sufficiently, except after the souring, when it must be thoroughly washed. By this means much labour will be saved.